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WIRING FACILITIES IN RESIDENCES.

The phenomenal progress made in the past few years by many central stations in the development of new business, particularly power business, which is very desirable on account of the demand coming at the off-peak period, has been responsible, to no small extent, in causing them to overlook the unlimited possibilities of increasing business on existing lighting circuits without additional expense.

There are probably very few central stations that would not spend considerable time and energy in securing a power contract that would yield a revenue of $100 per month. Yet the same revenue may be secured from smaller appliances as, for instance, the electric iron, if a sufficient number of them are installed, and with the advantage of no expense except for current. This is equally true of other domestic appliances, and while many of them, such as milk warmers, curling-iron heaters, heating pads, etc., cannot by themselves be considered much as revenue producers, each one where installed and giving satisfaction will lead to the freer use of current for lighting and other purposes, and will do much towards advertising the value of central-station service.

There is however a serious drawback to the general use of these appliances, namely, the present arrangement of interior wiring in most houses. The unsightliness of a coffee percolator, chafing dish, toaster or other dining-room appliance connected by a wire to a handsome dining-room dome, and the operation of a sewing-machine motor or an iron by a wire suspended from the ceiling and run from some distant chandelier is familiar to many and undoubtedly is a stumbling block for the central-station solicitor. Cases are not infrequent where it is necessary, in order to use one of the appliances mentioned, to first remove an incandescent lamp from a socket before attaching the plug of the device to be used, because there is only one socket in the room.

It is not strange then that rather than countenance this inconvenience, customers of central stations should use gas and alcohol appliances, although already possessing those manufactured to operate by electricity.

It is, of course, not feasible for central stations to remedy this evil where it already exists. However, it is obvious that the way of eventually doing away with this fault is the co-operation of the central station with the archi-

tect and electrical contractors towards the installation of proper wall and floor receptacles for operating such apparatus in the houses built in the future.

THE RATIO OF TRANSFORMATION.

The ratio of transformation of a transformer is an expression which may be used in several different senses, and it is time that engineers and authors of engineering books restricted its application to a specific and definite idea. When used in a general way, there is no question as to what is meant by the expression. The same is also true when it is used in a quantitative sense, if only its approximate value is considered and the direction of transformation is known.

Many words, such as power, energy, momentum—indeed, nearly every term used in mechanics—conveys a general idea when used ever so loosely, but to give an exact or quantitative idea to an engineer it must be restricted to its narrow technical meaning. This is equally true of ratio of a transformer.

At the present time there is no uniformity in the meaning given to the expression by different engineers and writers of textbooks. The term is used in at least five different senses. Perhaps the most common sense is the ratio of turns in the primary and secondary windings, but this is not the sense given to the words by those who have the most occasion to refer to the quantitative relations of transformers.

When a transformer is to be used in making accurate measurements, as in stepping down from high voltages or currents to the range of ordinary instruments, it is necessary to know the exact ratio of the terminal pressures, or of the currents. Owing to internal resistance and to magnetic leakage, the ratio of terminal voltages in a potential transformer is never quite the same as the ratio of turns. Consequently, at least in instrument transformers, it is customary for the manufacturers to slightly alter one of the windings, so that the nominal ratio is not the ratio of turns. The latter is not indicated on the name-plate and is usually unknown to the user. The name-plate should, and usually does, indicate the ratio of terminal voltages or of currents, at some particular load, for this is the ratio of interest to the user. This ratio depends upon the load, frequency, and other conditions of use, and is consequently a variable quantity. It has a definite value only under definite conditions.

When a numerical value is given to a transformation ratio, this value should indicate in itself the direction of transformation, without the qualification "step-up," or "step-down." That is, a ratio of ten should be understood to mean a step-down transformation and one-tenth a step-up transformation or *vice versa*. There is an inclination in some quarters to give the fractional value to a step-down transformation, but this is contrary to general usage. The expressions "transformation from ten volts to one volt," "transformation in ratio of ten to one," "ratio of transformation ten to one," "ratio 10:1" suggest the evolution of the last expression and it would be confusing to use the last with a meaning opposite to that of the first.

The committees on terminology or standardization of our national societies should give some attention to this matter, and to conform to reason and general usage the ratio of a potential transformer should be defined as the ratio of the effective voltage at the primary terminals to the effective voltage at the secondary terminals, and the ratio of a series transformer as the ratio of primary current to secondary current. These definitions would make the ratio a variable quantity, depending upon conditions of use. When the ratio is given without qualification it should be understood to apply to some standard conditions, such as rated load, frequency, etc., just as the speed of a motor or the voltage of a generator is understood to apply only to rated conditions.

THE BENEFITS OF A CENTRAL-STATION POWER LOAD.

Concrete examples of the advantages of the motor load in relation to the economy of electrical production in the central station multiply as managers address themselves to the active solicitation of power business. The past year's experience in a 4,500-kilowatt plant contrasted with that preceding a vigorous campaign for the acquirement of electric-motor customers shows conclusively the desirability of encouraging off-peak business combined with a large output, particularly in its effect upon labor and fuel costs per kilowatt-hour delivered at the busbar. The plant whose data are before us had precisely the same major generating equipment in 1909 as in 1910, but during the latter year the solicitation of electric power business was begun along the line of a systematic personal canvassing of the territory served, and this policy, combined with a substantial reduction from the old power rates maintained by the company, increased the power sales from 916,642 kilowatt-hours to 1,673,798 kilowatt-hours.

The station equipment consists of twelve horizontal return-tubular boilers, hand fired, of 3,000 nominal horsepower; a 1,500-kilowatt Curtis turbo-alternator, three engine-driven alternators of 2,250-kilowatt total rating, and six small belt-driven arc-lighting and railway-type direct-current generators. The record of the plant for 1909 shows that the total station output at the busbars was 5,754,268 kilowatt-hours, of which 4,879,973 kilowatt-hours were sold. The net cost of production at the station was $72,203, or 1.25 cents per kilowatt-hour, all fixed charges being excluded for the sake of a plant comparison. With the aggressive power-development policy of 1910, the company produced 7,126,314 kilowatt-hours, and sold 5,967,093 units, a gain of over 1,000,000 kilowatt-hours in the revenue output. The 1910

product was delivered at the station busbar at a net manufacturing cost of $73,332, giving the actual unit cost of 1.03 cents. This excellent result was in small part due to a reduction of 20.5 cents per ton in the price of coal.

Analyzing the details of the two years' production costs we find that in 1909 the fuel cost per kilowatt-hour delivered at the busbar was 0.68 cent, and that the total fuel expense during the year was $39,426. In spite of the heavy increase in the demands upon the station this year, the fuel cost per unit was 0.62 cent, and the total cost, $43,986. In other words the plant turned out about 1,370,000 more units in 1910 than in 1909, and the cost of the increase in fuel was only $4,560 more. The actual coal consumption of the plant per kilowatt-hour was 3.16 pounds this year compared with 3.34 pounds in 1909. A better argument could scarcely be found on behalf of the cultivation of the day load by the station, or better, the extension of its output over hours off the peak, whether in the daytime or at night.

Equally satisfactory results were evident in connection with the station labor account, and this in spite of an increase in the number of men required to handle the plant. In 1909 the station payroll covered the services of 21 men, compared with 23 in 1910. The total cost of labor in 1909 was $19,570, and in 1910, $19,954. As the subdivision of the labor account is not at hand, it is not possible to examine the details of this expenditure, and to ascertain what rearrangements of responsibility, if any, or what methods of charging, were practised. The totals show, howevver, that the cost of labor per kilowatt-hour was 0.34 cent in 1909 and 0.28 cent in 1910. There was a saving of about $1,700 in station repairs in the latter year which helped somewhat in the final gain in economy, but the main reduction was plainly due to the increase in the station output, and particularly to that supplied to power users, since it was handled without a cent's increase in the generating capacity of the installation. In six years, this plant, by improvements in its equipment and by enlargement of its output has brought its unit cost down from 1.56 to 1.03 cents. The lesson is plain.

TRAIN DISPATCHING BY TELEPHONE.

A glance over recent files of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN will disclose a large number of instances where railroad lines are installing telephones for train dispatching in place of the time-honored telegraph. In some cases the installations are on a short section of line and serving merely for trial and experiment. In other cases they mark a step in the complete substitution of the telephone for the telegraph, for once tried, the telephone is almost invariably adopted, and it is but a question of time to equip the entire line with the new system.

A number of the important trunk lines of the country have definitely decided to equip their entire mileage with telephones, and in certain instances the change has already been largely made. The Great Northern Railway and the Atchison, Topeka and Santa Fé Railway are conspicuous examples.

The Block Signaling and Train Control Board of the Interstate Commerce Commission, in a recent report, states that 290 railroads have been using the telephone to some extent and that over twenty-six thousand miles of track are already equipped. The growth is very rapid, and now that it has been adopted as a definite policy on a number of the large systems, the mileage will rapidly increase.

Some of the advantages of the telephone for train-dispatching are very obvious, and some others are not obvious except to the experienced railroad man. These advantages are clearly set forth in the first installment of an article by Mr. K. W. Endres, which appears in this issue. In future issues, Mr. Endres will present a full discussion of the subject, including a description of the technical details.

ELECTRIC LIGHTING FOR OUTDOOR SPORTS.

In addition to the electric lighting of baseball parks, as already reported in a previous issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, there is a field ready for development for the electric illumination of smaller areas for outdoor sports at night time. There are many popular games, as tennis, croquet, curling, basketball, handball, fives, and the fine old English game of bowls played on a greensward, which should afford a splendid opportunity for night illumination if the central stations care to solicit this kind of business. The lighting problems involved in these and other similar cases are easy of solution, and the aggregate business which would result from a determined campaign should well be worth the effort.

AN ELECTRIC-STOVE SUGGESTION.

Central-station managers are looking forward to the day when the electric stove will replace the other forms of cooking appliances now in common use. Any suggestion therefore, that will help forward this desirable consummation will prove of interest to our readers.

We have one to offer ourselves, and the idea occurred to us when we heard about an electric-stove demonstration given by a local manufacturer to the salesmen of the Commonwealth Edison Company, in Chicago. The test referred to took the form of a very successful dinner in which all the cooking was done by means of electricity.

Our suggestion is this: When some big dinner is to be given at a public place, let the local electrical company make an offer to provide electrical appliances and electricity free of charge for the preparation of the dinner, stipulating that the cooking be done entirely by electricity. The publicity that will naturally follow in the press, and the advertising that could be based on it, should well be worth the outlay involved.

Joint Electrical Meetings in Chicago.

The very successful joint meetings of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers that have been conducted for several years will be resumed this season. The joint committee in charge of these meetings is busily arranging a programme calling for at least one meeting each month until June. As has been customary for a number of years, Dr. Chas. P. Steinmetz will open the Chicago season with one of his interesting and instructive lectures. The subject will be announced later, but the date will probably be October 19 and the place Fullerton Hall in the Art Institute.

Convention of Railway Electrical Engineers.

The vast and largely unrealized importance of electricity in the operation of the steam railways of the country is shown by the fact that there is now a large and growing Association of Railway Electrical Engineers composed entirely of men in electrical departments of steam railways.

At the convention of this society to be held September 27-30 at the La Salle Hotel, Chicago, papers will be presented on such subjects as "Electric Lighting of Railway Cars," "Axle Generating Systems," "Electric Operation of Draw-Bridges," "Motor-Driven Machine Tools," and "The Illumination of Railway Passenger Stations and Machine Shops."

An interesting feature of the convention will be the exhibits by the member companies of the Railway Electric Supply Manufacturers' Association of electrical supplies used on railways. The first public demonstration of the nickel-iron Edison storage battery will be given, together with exhibits of the latest achievements of the electrical inventors, including the electric ozonizer and the loud-speaking telephone. W. E. Ballantine of the Willard Storage Battery Company will have charge of the exhibits.

George H. Porter is chairman of the arrangement committee. A reception, ball and banquet and entertainment for ladies will be provided.

George B. Colegrove, chief electrician Illinois Central Railway, is secretary and treasurer of the Association.

Pennsylvania Industrial Power Association.

At the annual meeting of the Pennsylvania Electric Association held at Glen Summit Springs, Pa., September 14, 15, and 16, the Pennsylvania Industrial Power Association was formed by the Class B members of the state association who are connected directly with the sale of electric power.

The purpose of the association is the compiling of reliable data which will be of aid to each member. It was decided for the first year to issue forms upon which each member will report on all installations on which he has reliable data. Such reports will be filed with the secretary and notices will be sent each member that reliable data are available on such installations and will be sent on request.

The meeting was very enthusiastic and it was voted to invite all power men to become affiliated either by geographical sections or as individuals. A fee of one dollar was charged each member to cover expenses of printing forms and mailing charges.

The following members were present: M. A. Pooler, Newcastle Electric Company; W. L. Mason, General Electric Company; J. B. Wharton, Wilkesbarre Gas and Electric Company; T. S. Hendrickson, West Penn Electric Company; T. E. Spence, Luzerne County Gas and Electric Company; H. S. Orth, Lycoming Electric Company; R. L. Lloyd, Philadelphia Electric Company; C. G. McAvoy, Bellefonte Electric Company; H. W. Waite, Easton Gas and Electric Company; A. L. Harte, Eastern Pennsylvania Light, Heat and Power Company; F. K. Woodring, Titusville Electric Company. N. F. Lewis, Scranton Electric Company, Scranton, Pa., was elected corresponding secretary.

Electric Vehicle Association of America.

The Electric Vehicle Association of America was incorporated under the laws of the State of New York on August 29, 1910.

On September 1 at the office of The New York Edison Company, occurred the charter meeting of the association. At this meeting, the constitution and by-laws were adopted, and officers and directors were elected as follows: President, William H. Blood, Jr., Boston, Mass.; vice-president, Arthur Williams, New York City; secretary, C. E. Firestone, Columbus, O.; treasurer and assistant secretary, Harvey Robinson, New York City; board of directors: H. H. Rice, F. W. Smith, P. D. Wagoner, Louis Burr, H. C. Cushing, Jr., Frank L. Dyer, James T. Hutchings, Louis A. Ferguson, W. W. Freeman, F. M. Tait, Hayden Eames, Charles Blizard.

The object of the Association, as stated in the constitution. "shall be to promote the adoption and use of electric vehicles for business and pleasure purposes." Corporations or firms engaged in the manufacture, development, or sale of electric vehicles, batteries, motors, controllers, tires or other electric-vehicle accessories; persons publishing trade papers; corporations engaged in the sale of electric current and any owner or operator of an electric vehicle or an electric garage are invited to join the Association.

The date of the annual meeting is the second Tuesday in October. It is the intention this year to hold a convention at the time of the fourth annual New York Electrical Show. It is the intention to appoint committees on Publicity, Standardization, Insurance, Charging Stations, etc. Monthly meetings will be held, and attractive papers read and discussed.

Provision has been made in the by-laws for the formation of association branches in the principal centers of local activity.

Long Tour Planned for Electrics.

It is announced that arrangements are being made for an experimental trip of two electric automobiles equipped with the new Edison storage battery from New York to Bretton Woods, N. H., over the route of the Ideal tour. The batteries will be recharged at the power house at Bretton Woods. This will be the first attempt to make a tour of a thousand miles by electric runabout.

Electrical Topics at the Iron and Steel Institute Meeting.

Among the papers which will be presented at the Buxton (England) meeting of the Iron and Steel Institute, September 26 to 30 next, are the following: "Electric Steel Refining," by Dr. F. Campbell; "Preparation of Magnetic Oxides of Iron from Aqueous Solutions," by S. Hilpert; "Utilization of Electric Power in the Iron and Steel Industry," by J. Schuurman.

Arthur Williams.

The central-station industry is probably unique in so far as development is concerned, for although its origin dates back only a few years, today it is recognized as a permanent industry in a highly developed state. Among the pioneers in the central-station field are many men, still young, whose activities today are just as conspicuous as in the early days when its success was problematical, and who are lending their every effort to the further development of the business.

Prominent in this respect is Arthur Williams, general inspector and agent of the New York Edison Company, and one of the widely known men in the central-station field.

Arthur Williams was born in Norfolk, Va., August 14, 1868, and received his early education in the public and private schools at New York, Brooklyn and Hartford. Recognizing the great possibilities of the electrical field, he abandoned an early desire to enter the United States Naval Academy and identified himself with Rennie & Smith, the authorized wiring contractors of the old New York Edison Electric Illuminating Company in September, 1884.

On February 6 of the year following, at the solicitation of the superintendent, Charles E. Chinnock, he entered the services of the Edison Electric Illuminating Company and was closely connected with the early history of the old Pearl Street station, in the city of New York, which was the very starting point of the electric-lighting industry in America. His work at this time was of a miscellaneous character, such as general repairs, lamp changes, reading of meters, etc. Step by step he advanced in importance in the company's organization, becoming station regulator, superintendent of interior construction, electrician, superintendent of the Third District, and superintendent of underground construction.

In 1890 he assumed the position of general inspector, and built up an organization which combines the functions of general agency and advertising bureau with those of general inspection. To his unusual ability in organizing this department, in obtaining the best men available, and by directly representing the company to the consumer, the New York Edison Company owes much of its success in the increase of customers' installations. In 1893 Mr. Williams was made general agent of the company; the work coming under this department, however, was carried on by him when he assumed the duties of general inspector.

ARTHUR WILLIAMS,
General Inspector and General Agent of the New York Edison Company.

In home and foreign electrical circles Mr. Williams' intimate knowledge, based upon his practical experience, of the commercial relations of the central station is regarded as authoritative, and he has made a number of valuable contributions to the literature in this field. Papers prepared by Mr. Williams and presented at various conventions on the subjects of "Isolated Plants," "The Relations of the Electrical-Supply Companies to Their Customers," and "Electric Elevators" are still considered as among the best material obtainable on the respective subjects.

Municipal ownership is a subject of vital interest to Mr. Williams, and through his extensive research he has become an authority. His reports on this subject to the National Electric Light Association are considered a valuable work.

In 1899 Mr. Williams was elected vice-president and two years later president of the New York Electrical Society. He has always been prominently identified with the National Electric Light Association and has served as second vice-president, first vice-president and on June 8, 1906, was elected president.

A man of tireless activity, Mr. Williams' membership in various clubs and associations affords him pleasure and relaxation. The American Institute of Electrical Engineers, National Electric Light Association, New York Electrical Society, the Electrical Club, the Engineers' Club, the National Arts Club, the Municipal Art Society, the Union League Club of New York, the Brooklyn Riding and Driving Club and the Yonkers City Club claim him as a member.

He is also vice-president of the Yonkers Electric Light and Power Company.

Temperature Coefficient of Magnetism.

At the meeting of the Paris Academy of Sciences on August 29, Prof. K. Houda presented a paper on the law of variation of the coefficient of specific magnetization of the elements with temperature. The author proposed to replace the laws of Curie by the following: The effect of a rise of temperature on the coefficient of magnetization of an element is similar to that of an increase in atomic weight. Experiments were described which supported this.

PACIFIC COAST ELECTRICAL EXPOSITION.

AUSPICIOUS OPENING AT SAN FRANCISCO.

Special dispatch to the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.)

SAN FRANCISCO, CAL., SEPTEMBER 19. —The Pacific Coast Electrical Exposition was opened on Saturday evening, September 17, by Mayor McCarthy, of the City of San Francisco, in the Coliseum, San Francisco, Cal. A large and highly interested attendance was on hand to attest to the popularity of things electrical.

Mayor McCarthy used the same key as was used by the beloved McKinley, on the memorable occasion of the launching of the battleship *Ohio,* in switching on the current, which set in motion the machinery of the exposition, and started into life myriads of incandescent and arc lamps.

There is a good deal of enthusiasm for things electrical and, in fact, a sort of holiday spirit prevails, for the festival of the Native Sons of California has just concluded, and in many streets the gala attire is still in evidence.

The daily newspapers are publishing special editions devoted to exploiting the various features of the exposition, and the United Railway Company is employing handsomely decorated and illuminated special cars over the various lines of the city to call attention to the new attraction. Credit largely belongs to D. M. Moses, for bringing to successful fruition the plans that have occupied the energetic San Franciscans for over a year. Much of the delay occasioning the postponement of the opening was caused by the slow process of restoring the Coliseum which was destroyed in the fire.

In fact, the building, though ready for occupancy, is not completed, and it was only by an evidence of the indomitable optimism and sturdy determination to overcome obstacles that has made the Golden Gate city the wonder of the world, that made it at all possible to open with all exhibits in place and the decorative features complete and well assembled. There is a well chosen and fairly comprehensive display of electrical equipment and supplies.

The National Electric Lamp Association occupies a prominent position with a fine display of Mazda, gem, tantalum, and carbon lamps for every purpose. The display of street series Mazda and tantalum street-car lamps is impressive and for the sake of better illumination it is to be hoped that the city departments and street-railway officials will discover these and apply a remedy sorely needed.

The General Electric Company is attracting much attention with its deservedly popular intensified arc. This is shown in some very handsome forms. Another General Electric feature attracting attention is an innovation in the form of a "White" cooking outfit. This brings out clearly the sanitary and cleanly features of electrical culinary operations.

The Westinghouse Electric & Manufacturing Company has a most extensive exhibition and it is attracting much attention and many callers.

There is a good sprinkling of vacuum cleaners, electric signs, electric glassware and fixtures, piano players, surgical apparatus, heating and cooking devices, some novelties such as the telautograph, directograph, adding machines, and a display of electric automobiles that would do credit to a city of much greater population and fewer hills.

The local telephone companies, the Western Union and the City Electrical Department are making comprehensive and really interesting displays and demonstrations and the Southern Pacific Company is boosting automatic electric interlocking while it adds to the picturesqueness of the show and distributes a mass of attractive travel literature.

At the moment it is hardly possible to estimate the absolute value of the show to electric interests of the Coast, but a partial canvass finds the exhibition well satisfied with both the number and character of those in attendance. A. A. G.

New Physical Laboratory for University of Chicago.

A contract has been let for the construction of a new laboratory to connect with the present Ryerson Physical Laboratory at the University of Chicago. It will be three stories high, of Bedford limestone, in the English Gothic style of architecture. The building will cost $100,000 and is the gift of Martin A. Ryerson, president of the board of trustees.

DEPRECIATION AND APPRAISALS.

ADDRESS BEFORE CHICAGO ELECTRIC CLUB.

The subject of depreciation is an important one to all engaged in the operation of electrical properties, or the sale of electrical machinery and apparatus. At the regular weekly meeting of the Chicago Electric Club on Wednesday, September 21, Frank F. Fowle, consulting engineer, Chicago, delivered an interesting and instructive address on this subject, pointing out the essential conditions that have to be met and outlining the most approved practice in use by electrical companies.

All properties are built of material and contain machinery and apparatus that depreciates and the factors that constitute depreciation consist of first, wear and tear, particularly in regard to machinery and apparatus; second, corrosion and decay, such as in poles, lines and apparatus exposed to the weather; third, obsolescence, and fourth, inadequacy.

The speaker stated that depreciation must be taken care of for two reasons, first, to protect the investors, and secondly, to provide funds for reconstruction. However, the problem of how to finance depreciation is the all-important one and the following aspects of the problem must be considered, namely, the financial, the economic and the physical aspect.

Two methods of arriving at a depreciation fund, as commonly employed, were outlined by the speaker, who illustrated his description by a specially prepared chart.

The first method and the one preferred by the speaker is known as the straight-line method. In employing this method it is assumed that a property depreciates uniformly each year for the scheduled life of the apparatus and a certain fund is each year set aside until the entire investment is written off.

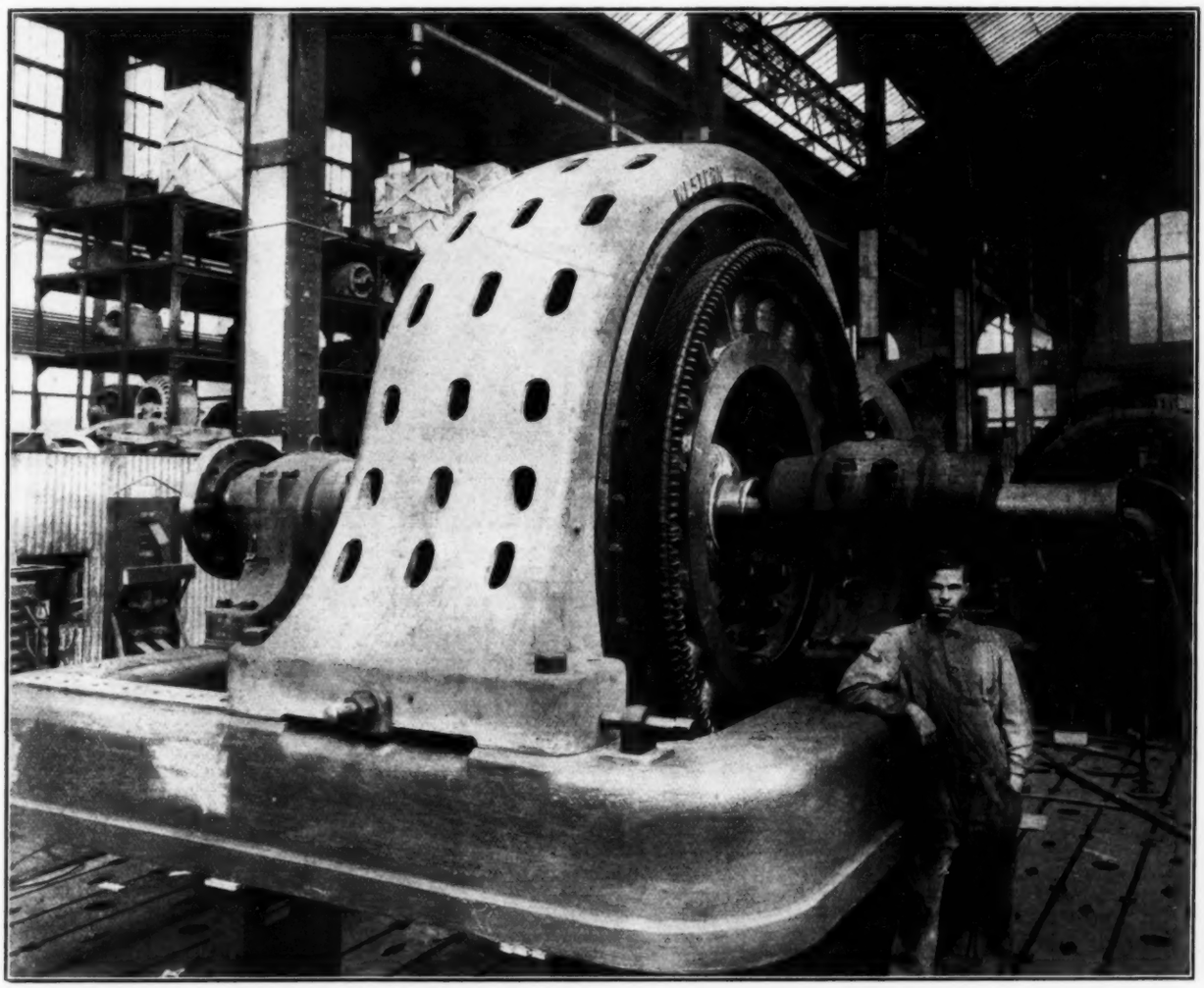
The second method is known as the sinking-fund method and amounts to setting aside each year a certain predetermined percentage of the investment until the fund plus the accrued interest amounts to the investment in the property.

Brief remarks were also made by Wm. B. Jackson, L. B. Marks, Harold Almert and Wm. S. Taussig.

A 4,000-Horsepower Hydroelectric Development in Utah.

New Plant of the Utah Light and Railway Company.

The Utah Light and Railway Company, of Salt Lake City, Utah, has outgrown its present equipment which includes power stations at Ogden Canyon, Salt Lake City, and Cottonwood Canyon, and is constructing a 4,000-horsepower hydroelectric plant on the Weber River to operate at full capacity in parallel with the existing stations in order to take care of the increase in the company's load. The location of the new plant is at a point near the place where the Weber River emerges through its canyon in the Wasatch Mountains, and is about twelve miles southeast of Ogden, a city also supplied with electric light and power by the Utah Light and Railway Company.



GENERATOR FOR WEBER RIVER HYDROELECTRIC DEVELOPMENT.

The water from the Weber River is conveyed to the power house by a large wooden-stave pipe of Oregon fir, 7,075 feet in length and seventy-four inches in diameter, which terminates at the lower end in a seventy-four-inch steel pipe, 100 feet in length, and is fed at its upper end by another pipe, of redwood, 2,000 feet in length and eighty-four inches in diameter. This in turn is supplied by a reservoir banked up by an overflow concrete dam situated on the river about three miles from the mouth of the canyon. The spillway of this dam is 65.5 feet long at the crest and will discharge with a two-foot head of water a volume of 5,320 cubic feet of water a second, or 790 cubic feet per second more than the highest recorded flood, which occurred in May, 1890. The effective head of water at the power house is 138 feet. The engineering features of the construction of the waterways to the power house presented some difficulties on account of the local topographical conditions. These were described at length in an article in the *Engineering Record*, April 2, 1910. This account deals only with the power-house equipment.

The power house is built of brick on a substantial foundation of concrete and reinforced concrete laid on bed rock at the foot of one of the steeply sloping sides of the canyon. It is 76.5 feet long and 56.5 feet wide. It is divided into two principal parts, the generator unit being contained in a room thirty-three feet wide running the full

length of the building, the remaining space being devoted to the housing of the transformers, switches, and other apparatus.

The generator, which was constructed by the Western Electric Company, is of the two-bearing waterwheel type, designed for connection at one end through a bolted flange coupling to a 4,000-horsepower Pelton turbine and at the other end to a 2,000-kilowatt, thirty-cycle, revolving-field alternator to be installed later.

The alternating-current generator is rated at 2,500 kilowatts at unity power-factor with a normal speed of 360 revolutions per minute and is wound for three-phase sixty-cycle 2,300-volt alternating current.

The rotor is provided with a squirrel-cage winding to be used in starting as a motor from half-voltage taps on the transformers.

The current taken from the line for starting under friction load when connected to the 2,000-kilowatt generator will not exceed full-load current.

The windings of the field consist of copper strap wound on edge. The whole rotor is designed so that the variation in voltage with constant excitation and unity power-factor will not exceed the values given in the table.

Variation of Load.	Variation of Voltage.
No load to full load	6.6 per cent
No load to twenty-five per cent overload	9.1 per cent
Full load to no load	7 per cent
Twenty-five per cent overload to no load	10 per cent

The efficiencies when operating at normal voltage, frequency and power factor are given in the other table.

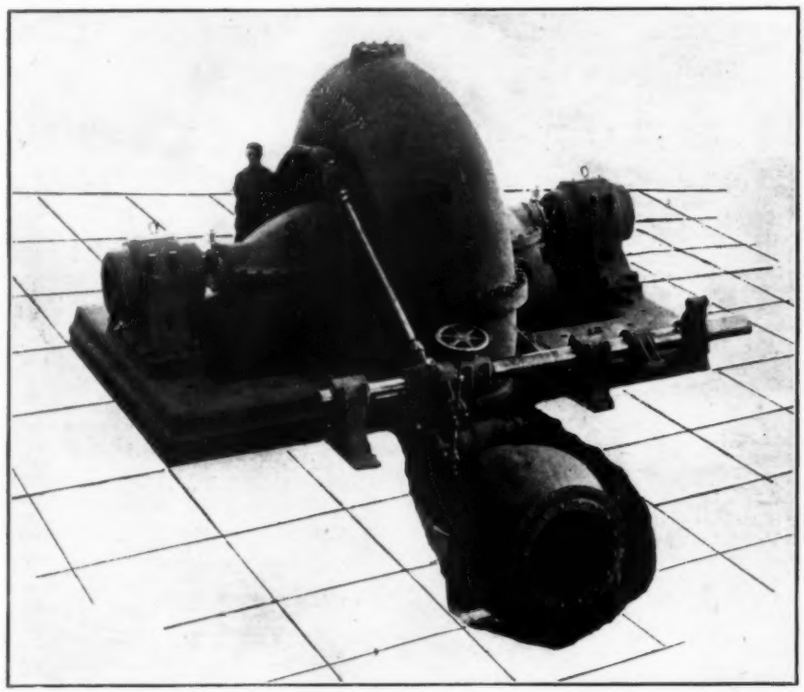
Kilowatt Output.	Percentage. Rated Load.	Efficiency Including Excitation.
625	25 per cent	88.0 per cent
1,250	50 per cent	93.6 per cent
1,875	75 per cent	95.4 per cent
2,500	100 per cent	96.1 per cent
3,125	125 per cent	96.3 per cent

The maximum height of the machine is nine feet ten inches, and the floor space required twelve feet six inches by sixteen feet 6 inches.

The exciters include one belted exciter of forty kilowatts at 125 volts, and one motor-generator exciter consisting of one forty-kilowatt, 125-volt generator, direct-connected to a sixty-horsepower, 2,300-volt induction motor.

The waterwheel unit was furnished by the Pelton Water Wheel Company, San Francisco, Cal. The illustration which is shown herewith does not include the shaft and flywheel; only the general ensemble of the unit with the relief valve seen under the floor is given. The water entrance is at a point directly under where the man is seen standing in the illustration.

The turbine unit is capable of developing 4,000 horsepower at normal load and about seventy-five per cent gate opening. The maximum horsepower at full gate opening is about 5,000, the speed being 360 revolutions per minute. Generally speaking, the turbine is of the Pelton-Francis spiral-case type having a single double-discharge runner made of bronze. The wicket gate or speed-controlling mechanism is all outside the turbine casing, and heavy navy-bronze removable liner plates are provided in the turbine throat so that in the event of wear suitable replacements can be made without difficulty. The bearings are of the ring-oiling ball-and-socket generator type, with provision made for water-cooling of the oil. The turbine is controlled by a Pelton-oil-pressure governor which is complete with accumulating tanks and water-driven oil-pressure pump.



WATERWHEEL UNIT FOR WEBER RIVER HYDROELECTRIC PLANT.

To Electrify Hoosac Tunnel.

Officials of the Boston & Maine Railroad have confirmed a report that the electrification of the Hoosac Tunnel would be one of the first improvements of the system to be pushed by Charles S. Mellen, as acting president of the road. Since gaining control of the Boston & Maine the officials of the New York, New Haven & Hartford Railroad have paid considerable attention to the Hoosac Tunnel problem, and President Mellen decided that the abolition of the smoke nuisance in the tunnel was imperative.

Engineers have been at work on the details involved, and it is stated that nearly $1,000,000 will be spent for the change, including the cost of electric locomotives. When the changes are completed both passenger and freight trains will be taken through Hoosac Mountain by electric power from Tunnel Station on the east to North Adams, and possibly Williamstown, on the west side.

The Triborough Subway.

Some idea of the magnitude of the work that must be done if the New York Triborough subway is built may be gained from figures recently given by the Public Service Commission.

The entire system, including elevated extensions, embraces 44.2 miles, or 133 miles of single track, as compared to twenty-five miles and 81.2 miles respectively for the interborough subway.

The engineers estimate that the earth and rock to be excavated at 9,158,000 cubic yards will be more than double the amount excavated for the present subway. There will be about 1,865,000 cubic yards of cement used. Of steel and iron there will be about 302,000 tons.

PENNSYLVANIA ELECTRIC ASSOCIATION.

THIRD ANNUAL CONVENTION AT GLEN SUMMIT SPRINGS.

The third annual convention of the Pennsylvania Electric Association was held at Glen Summit Springs on September 14, 15 and 16, and proved to be very successful from every point of view. The meetings were interesting and well conducted, and the entertainment committee performed its functions in a very pleasing and satisfactory manner.

The sessions were held at the Glen Summit Springs Hotel, the official headquarters. The initial session on Wednesday morning was opened with the address of the president, E. L. Smith, of Towanda, and this was followed by the reports of committees. An abstract of the report on "Overhead Line Construction" follows:

OVERHEAD LINE CONSTRUCTION.

The report of this committee, which was in five parts, principally reviewed the 1910 report of the similar committee of the National Electric Light Association and offered some friendly criticism and suggestions. In the introduction it is recommended that the new committee act in a limited advisory capacity to the member companies, particularly on joint use of pole lines, railroad crossings, etc. It was also recommended that the new chairman be a member of the executive committee. Section 1 of the report was a criticism of the 1910 report of the national committee. It was suggested that a lighter construction be permitted on private lines and alley circuits. The maximum distance that secondary circuits should run from transformers should be left to suit local conditions. The grouping of transformers on secondary systems is sometimes advisable. The use of a grounded neutral as a lightning-arrester ground is not approved. Special construction for railroad crossings is not recommended for circuits below 6,600 volts. Section 2 of the report was a review of the paper presented by Paul Spencer at the 1908 convention of the National Association on the subject of joint use of pole lines, the most striking features of his paper being pointed out. Section 3 considered the St. Louis report of the committee on preservative treatment of poles and cross-arms, but did not concur in recommending the treatment of more than the pole butt; the erection of a preserving plant run on a co-operative basis was advised. Section 4 was a paper on the "Sag and Span Question," by George C. Wendle and W. L. R. Robertson, in which the present formulas for the stringing of wires are declared to be too inaccurate for much of the precise work now required. The authors have undertaken an exhaustive investigation of the subject and much data has been collected on the pole lines of the Philadelphia Electric Company. Revised formulas are being worked out and simple but comprehensive tables for the use of linemen are being compiled. These will be submitted in a future report. Section 5 gives some specifications for insulating friction tape for outside work.

The recommendation of the committee was carried out by making its chairman, Thomas Sproule, a member of the executive committee.

The report was discussed by Messrs. McCabe, Wendell and Noecker, in regard to the joint use of poles, construction of lateral lines, the adoption of agreements which could not be lived up to because practically impossible, and the legal aspect of the question. It was suggested that twenty-four inches was more suitable than thirty-two inches for the clearance between lines.

J. F. Francis, of the Bell Telephone Company, stated that that company aimed to cultivate pleasant relations with the lighting companies, and was willing at all times to accommodate where changes in its lines were necessary. He enumerated some of the telephone troubles experienced, especially excessive noise due to the proximity of a three-phase, star-connected system with a grounded neutral.

Mr. Green, of Altoona, explained the method of grounding lightning-arresters, using coke and iron filings and the freedom from trouble since its adoption.

In the matter of railroad crossings it was suggested that the only way to deal satisfactorily with the growing restrictions is to take a stand as a unit in resistance to the demands of the railroad companies. The matter will before long probably receive attention from a state commission and the concessions of today will become the laws of tomorrow. Several actual cases were cited showing the absurdity of the specifications of the railroads' engineers.

A paper by C. R. Bishop on "Steam Heating" was then presented.

STEAM HEATING.

At the outset of his paper, Mr. Bishop points out that in Pennsylvania there are a greater number of cities having district heating service than in any other state and there is also the most extensive steam distribution in existence. The early underground piping systems were very crude affairs and it is surprising, in view of present practice, that any degree of success was achieved at all in those times. The evolution of underground work has been wonderful. It is now realized that success depends very largely upon its perfection and that it is necessary to place its installation in the hands of qualified experts. Although the proper design, insulation and installation of underground steam piping costs more than any other type of conduit work, its returns per dollar invested are also greater. District-heating service is justly popular. Steam can be generated in a large central plant much cheaper than in a multitude of small plants. The most reliable reports obtainable show that in a well constructed underground system the transmission losses are very low. Therefore heating from a central station is a decidedly profitable proposition, when conducted with the proper equipment. Mr. Bishop again emphasized the importance of thorough insulation and the best construction in the piping system so as to prevent heat and friction losses. As the transmission losses are independent of the quantity of steam passed, it is evident that in a sparsely settled district even a perfect system is unprofitable. Assuming the meter system of charging at say fifty cents per 1,000 pounds of steam, which is the average under the conditions prevailing in Pennsylvania, an income of twenty to twenty-five cents per dollar invested should be possible in any district reached by the heating system. Although in that state the majority of heating plants confine their attention to that service alone, the number of combination electric and heating plants is increasing faster. Mr. Bishop presented figures from operating companies comparing combination plants and heating plants alone, which showed a decided advantage in the case of the former. He also pointed out the strong position that a combination electric and heating company has by virtue of its ability to solve the isolated-plant problem and to ward off competition. In order to insure the highest economy a heating company should maintain complete records of weather conditions, fuel and water consumption, steam and electric output, line losses, as well as full data of the buildings heated.

This paper was discussed by Messrs. Fogarty, Kiefer, Lloyd and Granger. It was shown that where charges were made by meter, considerable saving to the heating company resulted. A minimum charge is generally enforced. The meters should be taken to the power house every summer, cleaned and oiled.

The session on Thursday morning was opened by the address of W. W. Freeman, president of the National Electric Light Association. Mr. Freeman emphasized the importance of the geographical or state sections of the national body, laying particular stress on the importance to the small companies of being allied with the Association. He complimented the Pennsylvania Association as being the largest and most enthusiastic it had been his pleasure to attend.

This was followed by an address by T. C. Martin, secretary of the National Association, who spoke along similar lines and gave figures exhibiting the phenomenal growth of the parent body. He referred to the value of the solicitor's handbook and the desirability of so arranging it that new pages and data could be added as issued, when new material was obtained.

T. C. Coghlan then read a paper entitled:

ADVANTAGEOUS POINTS IN STATION OPERATING.

Mr. Coghlan's paper is a review of the most important points to be watched continuously in order advantageously to promote the economy of any central station.

Beginning with the purchase of the coal, which is most advantageous on the heat-unit basis, he passes to the need of skilled men to operate the furnaces, where intelligence is of greater value than mere brawn. The need of keeping thoroughly complete and systematic records of boiler and engine-room performance is emphasized and the ease of doing this is made clear. Mr. Coghlan advocates keeping a check on the work of each fireman by the use of a CO_2 recorder on each group of furnaces controlled by him, by the frequent use of an Orsat apparatus and by analysis of ash at each cleaning; he contends that these tests are as important as, if not more important than, the use of an indicator on the engines; the absence of smoke from the chimneys does not prove efficient firing because there may be a great excess of air in the flue gases. The temperature of the feed water must be watched carefully as every increase in it means fuel economy. Insulation of the piping and thorough exclusion of leaks in the furnace and boiler setting are highly important. All condensation from the steam system should be returned to the boilers. Periodic inspection of the entire plant equipment is imperative, some parts requiring examination daily. Defects should be repaired as soon as discovered, in order to keep everything in workmanlike condition. A forced oiling system is the means of considerable economy in the use of oil. The oil in waste can advantageously be pressed out and the waste washed and used again. Cleanliness of the entire plant denotes orderliness. Safety appliances and safeguards should be liberally supplied to prevent accidents to the plant employees. Finally a thoroughly efficient and reliable organization of the staff is necessary to insure attainment of the best results.

This paper brought forth a free discussion by Mr. Franklin, of Easton, and others. It seemed to strike home to every station superintendent in the meeting. A difference of opinion was expressed as to the treatment of the water. One experience developed that it was more expensive to attempt to remove impurities before entering the boiler as the scale removers were amply effective. This view was opposed by others, but it was agreed that what best suited water in one section might be entirely unsuitable in others.

Due to the variable composition of river water at different seasons, a monthly or weekly analysis was recommended so that corresponding boiler compound could be used.

The next paper was on "New Types of Lamps from the Operating Standpoint," by George E. Brett.

NEW TYPES OF LAMPS.

Mr. Brett's paper is a candid statement of the opinions of a practical man about the new types of lamps that have now come into vogue. After a reminiscent glance at lighting conditions in the eighties and early nineties, he takes up the flaming-arc lamp and, while conceding its high illuminating value, questions whether this compensates for the additional expense of trimming. The luminous arc or magnetite lamp he considers to be a marked advance in the science of lighting. For street lighting they will doubtless be extensively used; the 6.6 and 7.5-ampere series lamps of this type have a particularly bright future, as they enable much greater light to be produced at the same cost, which is a good policy to follow. After a hasty review of the improvements in incandescent lamps from the carbon to the tungsten types, Mr. Brett considers the application of the latter to special street lighting. He advocates the use of the low-voltage tungsten lamps for this purpose and describes in some detail an arrangement of arch lighting with ten lamps equipped with steel enameled reflectors and connected in multiple-series across the 110-volt circuit. In all street lighting the object should be to light evenly the entire space between the walls of buildings on either side, instead of the roadway or sidewalk principally. For column lighting a height of twelve to fourteen feet above sidewalk is best for mounting the lamps. Tungsten clusters of five 100-watt lamps placed in one sixteen-inch globe and four twelve-inch globes give the best results. Each standard is a 500-watt unit and should be placed 75 to 100 feet from adjoining units. As such lighting is usually supposed to be decorative much attention should be given to the ornamentation to see that it is not overdone. The Corinthian type of column is most pleasing. The installation of such lighting systems should be made in a durable manner and the posts regularly painted. Turning to sign lighting, Mr. Brett calls attention to the value of electric signs, particularly when equipped with tungsten lamps which give a much whiter light than the old sign lamps. Low-voltage tungstens operating from an auto-transformer are best adapted to this purpose. The V-shaped filament is better for signs against the face of a building; the M-shaped filament for those projecting out over the sidewalk.

The principal point of interest brought out in this discussion was the question of liability of the lighting company if street lamps were hung low over a roadway by direction of the town or borough authorities. Some interesting figures were obtained when gas-mantle lamps were measured for candlepower where there was a competition for a street-lighting contract. The discussion was participated in by Messrs. Gibson, Stickney, Greene, Cooper, Anderson, Muth and others.

The closing paper of the session was entitled "Operation of Electric Vehicles," by W. A. Manwaring.

ELECTRIC VEHICLES.

In opening his paper Mr. Manwaring called attention to the marked advantages of electric vehicles over horse-drawn vehicles and stated that these will soon become so well known that it is safe to predict that in a few years automobiles will have entirely superseded horses for commercial purposes. Among these advantages of the electric vehicle are: It covers more distance and travels faster; requires less stable room and less space on the street; can be stored in or near the warehouse; reduces insurance; can be worked for longer hours and on every day; does not litter or damage the street; requires less delivery units and does more work in less time; can be euipped with a motor to pull cable, erect poles, hoist safes, etc.; is modern and a good advertisement. Every electric vehicle added to a central station's circuits represents a considerable load; thus a one-ton car requires about nineteen kilowatt-hours per charge, and a five-ton car about forty-seven kilowatt-hours. This means for a single vehicle alone from 5,700 to 14,100 kilowatt-hours per year of 300 daily charges. The author then gave a series of performance data from the experience of a large electric light company with electric vehicles purchased in 1905 and in 1908. Eleven one-ton cars averaged 1.21 kilowatt-hours per mile on 409 miles covered per month for a period of two years. Two three-ton cars averaged 2.14 kilowatt-hours on 207 miles per month; two other three-ton cars averaged 1.94 kilowatt-hours; a 1,000-pound car averaged 0.715 kilowatt-hour on 602 miles per month for eighteen months. Data on battery performance in these vehicles were also presented. Also data on rubber tires.

The discussion was opened by W. White, of the General Vehicle Company, who called attention to the great advances which had been made in weight and efficiency. This is readily seen by comparing the data of machines with their dates of manufacture.

R. L. Lloyd gave some interesting figures comparing the cost of operation of electric and gasoline-propelled business wagons, obtained from a reliability run from Philadelphia to Atlantic City and return. The results were decidedly to the advantage of the electric cars. Attention was also called to the superiority of these cars in hilly cities, because of the reserve power in the storage battery.

Mr. White then answered several questions as to first cost and upkeep of the electric compared to the gasoline wagons. In general, electric wagons have a higher initial cost but a much lower maintenance cost.

Friday was "commercial day," and D. T. Campbell presided at the meeting. The first paper was on "Rates," by L. H. Conklin.

RATES.

This paper presents a number of well founded arguments in favor of a more concerted and thorough study of the question of rates. The paper states that the first step in making up a proper rate scheme for a given station is to analyze the cost to that station of the service to its customers. In this connection reference is made to the paper presented by S. E. Doane at the St. Louis meeting of the National Electric Light Association on this subject. Referring to the tungsten-filament lamp the paper points out the introduction of these lamps has interested three classes of people—the customer, the central station and the manufacturer, and up to the present time the central station is the only one that has not directly profited. After a brief analysis of the commodity sold by a central station the author draws the conclusion that the company sells light and points out that light should be charged for on the basis of candlepower. The author considers the so-called three-rate scheme as being nearly theoretically correct and along these lines submits a rate based on a charge of three-fourths cents per month per candlepower of the demand as agreed upon, plus three and one-half cents per kilowatt-hour of the energy used, combining, however, the customers and demand charges. When conditions warrant it, this demand can be readily re-

duced and a customers' charge submitted for the portion dropped off. The rate for power is worked out on the same basic principles. The charge consists of a charge per kilowatt-hour depending upon the hours use per month of the customers' demand. This maximum demand may be measured or agreed upon in advance. The hours use of this demand determines the gross rate regardless of the size of the installation.

This was followed by a paper on the same subject by Mr. Cooper, who proposed a solution of the rate problem based on the ideas advanced by S. E. Doane at the meeting of the National Association. It was illustrated by drawings and lantern slides, and contained much food for thought.

E. J. Kiefer, of Easton, followed with another solution, which penalized the short-hour user and gave the advantage to the consumer with a high load-factor. It was illustrated by elaborate drawings and blue-prints.

The discussion on these papers was lively and interesting and was participated in by Messrs. Perkins, Davis, Kiefer, McCabe, Lloyd and others. Mr. Davis claimed that he had yet to be shown a differential rate which would be applicable in all cases or which would stand in law.

The question of a demand meter was brought up and it was not shown that the cost of this apparatus was warranted in the majority of cases. It seemed to be the consensus of opinion that the introduction of the tungsten lamp was not such a calamity as some theorists were trying to make out, that the application of a three-division charge for electric service is entirely impractical, and that the whole question will settle itself in a natural and quiet way before the universal adoption of tungsten lamps occurs, even supposing such a condition will ever be achieved.

The next paper was by H. M. Blake and was entitled "Investment Justified by Smaller Companies for Securing Power Business."

INVESTMENT FOR SECURING BUSINESS.

The paper covers the subject of permanent investment in generating and distributing equipment and applies equally to large companies as well as small, that is, the investment justified depends entirely upon the rate of interest desired and as to whether each particular situation will give this return. The paper points out that many central-station managers assume that power business is off-peak business and therefore the returns should be made to cover only interest and depreciation on the investment directly necessary to take on this business plus the bare manufacturing cost. The author is of the opinion, however, that aside from special cases of off-peak business, all business taken on by any company should be made to cover its proportion of plant investment and other fixed charges. The theory of making low power rates to ten-hour consumers is, according to the author, not correct, as there are very few instances where such consumers do not overlap the load peak during the winter months and therefore should be classed as peak business. Investments made to protect present business against competing plants or isolated plants could be justified even without any immediate financial returns. After considering business requiring investment it must not be forgotten that a large amount of business can be gotten on the existing lighting and power circuits without any additional investment whatever, such as ice-cream freezers, dough mixers, cooking utensils, sewing-machine motors, etc. The author states that this class of business is being overshadowed by the enthusiasm to secure larger power business whereas in reality it should receive first consideration.

This was followed by a spirited discussion by Messrs. Perkins, Granger, Greene, Woodring, Lloyd, McCabe, Davis, Kiefer, Wendell, Cantlin, Conklin, and others. Exception was taken to the statement that long-hour power business which crosses the peak should not get the advantage of low rates.

Methods practiced in the taking over of gas engines and steam plants were explained and the subject of peak load, its duration and occurrence received due consideration. The question of what proportion of the total income should be derived from power was answered variously, depending upon the locality and the conditions existing. It was shown to vary from nothing up to fifty per cent or even seventy-five per cent.

The concluding papers were on "Domestic Appliances," William A. Donkin, James E. Pyle and Thomas C. Walsh each presenting a contribution on the subject.

DONKIN'S PAPER.

This paper discusses the advantages to be derived from a consistent effort to promote the use of domestic appliances. Domestic appliances as manufactured today may be divided into two classes: First, those which can be operated on present lighting circuits, such as small heating appliances, portable machines, etc.; second, stationary appliances, such as stoves, stationary vacuum cleaners, etc., that require separate circuits. Considering the electric flat iron as the best revenue producer of these appliances, the author outlines the methods adopted by the company he is connected with in pushing their sale. Electric vacuum cleaners, cook stoves and washing machines are considered. The author, however, considers the high cost of these as a serious drawback to their general use. Regarding the smaller appliances, the author considers the present arrangement of interior wiring as a serious drawback to their installation and recommends central stations to co-operate with architects and contractors in having convenient floor and wall receptacles provided in houses for operating such devices.

PYLE'S PAPER.

This paper treats of the economy of domestic appliances and discusses primarily the construction of such apparatus, with particular reference to electric cooking. Commenting on the present electric stove, the author points out the requirements that are essential to its success, of particular importance being a stove that will supplant the ordinary gas or coal range and one constructed so as to maintain heat after the current has been turned off. The paper outlines an experiment along these lines which showed an appreciable saving in the cost of preparing a meal by electricity as compared with gas.

WALSH'S PAPER.

This paper briefly outlines a method adopted by a central station in pushing the sale of electric flat irons which resulted in a large number of sales being made. The method consists of giving to each customer as he pays his monthly bill a certificate entitling him to an iron to be used on trial for thirty days. Solicitors follow up these customers and find out whether the iron has proved satisfactory.

The discussion centered about the electric iron, the means of introducing it and the income derived. Messrs. Davis, Greene, McCabe and others participated.

Special attention was drawn to the long trial period, thirty to sixty days, mentioned in the paper, and it was generally conceded that better results were obtained by a fifteen-day period. This also resulted in the carrying of a very much smaller stock of irons.

ELECTION OF OFFICERS.

The following officers were elected for the ensuing year: President, A. R. Granger, of Chester; vice-president, R. S. Orr, of Pittsburg; secretary and treasurer, Van Dusen Rickert, of Pottsville.

A number of the Class B members organized the "Pennsylvania Industrial Power Association," an account of which will be found upon another page.

Scottish Exhibition, Glasgow, 1911.

It is stated by *Electrical Engineering*, of London, England, that an exhibition of National History, Art, and Industry will be held in Kelvingrove Park, Glasgow, Scotland, from May to October next year. A large hall will be set apart for engineering, scientific, and industrial exhibits, and a special building to be called the Kelvin Hall will be devoted to electrical apparatus and machinery. The "Lord Kelvin Electrical and Engineering Committee," with Prof. Andrew Gray and J. G. Gray as conveners, will be responsible for this section. Electricity supply at 250 volts and 500 volts, direct current, will be available. Further particulars and space application forms can be obtained from the manager, W. H. Knight, 190 West George Street, Glasgow, Scotland.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION.

PROGRAMME OF THIRTEENTH ANNUAL MEETING.

The thirteenth annual meeting of the Kansas Gas, Water, Electric Light and Street Railway Association will be held at Kansas City, Kans., September 27 and 28. An interesting programme has been arranged and papers of technical and practical nature will be read.

After the address of welcome by Mayor J. E. Porter, and the reply by L. O. Ripley, chairman of the executive committee, W. T. Flynn of Kansas City will make the presidential address.

The following papers will be read:

"Prevention of Accidents," George E. Hayler, Joplin, Mo.; "Boiler Water Troubles," C. C. Young, Lawrence; "Electric Vehicles from a Central Station Standpoint," B. F. Eyer, Manhattan; "Co-operation Between Manufacturer and Central Stations," Harry G. Glass, Pittsburg, Pa.; "Troubles of a Water Commissioner," John G. Pease, Junction City; "The Heating Values of Kansas Crude Oils, Fuel Oil Residues, and Distilled Oils," P. F. Walker, Lawrence; "Central Station Methods of Securing New Business," J. D. A. Cross, Chicago, Ill.; "Financing a Plant in a Small Town," H. A. Walker, McPherson; "Comparative Cost of Oil and Coal," W. E. Sweezey, Junction City; "Review of Work of Utility Commission of Wisconsin," George C. Shaad, Lawrence; "Transformers," E. L. Buchanan, Chicago, Ill.; "Rates (Water Works)," J. H. Wathert, Junction City; "Value of Pure Water," R. E. McDonnell, Kansas City, Mo.; "The Cost of Electric Light," J. T. Skinner, Lawrence; "Holophane Illumination," T. C. Hawkins; "The Other Fellow," L. O. Ripley, Wichita; "Electric Standardizing Laboratory at K. U." C. A. Johnson, Lawrence; "How to Get Motor Business," W. R. Murrow, Independence; "The Advantage of a Sales Department," J. B. Kennedy, Wichita.

These papers will be followed by an address by Edwin R. Weeks, of Kansas City, Mo., and the sessions will then conclude with the "Query Box."

Copper exports for the week ended September 15 were 10,483 tons; since September 1, 15,796 tons.

New York Asks Subway Bids.

Preparatory to relieving the daily increasing congestion on present transit lines in Greater New York bids for new subways, with forty-one miles of trackage, have been advertised for by the Public Service Commission. The entire work will cost approximately $125,000,000, and will include new underground connections in Manhattan, Brooklyn and the Bronx, grouped under the general title of the Tri-Borough Subway. Replies from contractors must be received not later than October 27.

The advertisement specifies two plans of construction, one entirely by private capital, the other with city money. If the latter be adopted the work will be done piecemeal, as only $60,000,000 in municipal funds is available.

New England Section of the National Electric Light Association.

The summer convention of the New England Section of the National Electric Light Association was held at the Griswold, New London, Conn., on September 13 and 14. There were about 250 members and guests present and the meeting was a very successful one.

Arrangements were made for the observance of the birthday anniversary of Thomas Davenport, inventor of the electric motor, at Brandon, Vt., on September 28 in connection with the meeting of the Vermont Electrical Association.

On Monday evening there was a reception by the officers of the association to the members and guests. On Tuesday morning the president, Alexander J. Campbell, of the New London Gas and Electric Company, surprised the members by raising on the flagstaff of the hotel a pennant containing the emblem of the association. The pennant was thirty-two feet long.

At the opening session on Tuesday, President Campbell made an address and reports were heard from various standing committees. A paper was read at this meeting by Howard Corning on "The Advantages of a Uniform System of Rate Making."

After lunch, the steamer *Restless* carried the members to Fort Wright, where gun practice and drills were observed. In the evening a banquet was held, the arrangements being in charge of W. M. Lewis.

At the close of the banquet, L. D. Gibbs, the secretary, gave his paper on "Illuminated Advertising—Its Possibilities," illustrating it by means of a stereopticon. Unique signs in different places were shown, and attention called to some of the ways in which central stations can explain their methods of operation and the advantage of electric service by means of lectures to improvement associations, business-men's clubs, etc.

At the Wednesday session papers were read by J. A. Hunnewell on "Street Lighting," and by L. J. Chase on "Opportunities."

Abstracts of the papers will be given in a later issue.

Western Society of Engineers.

The first meeting of the season of the Western Society of Engineers was held in its spacious quarters in the Monadnock Block, Chicago, on September 7 with President J. W. Alvord in the chair. Secretary Warder announced the formation of a new section of the Society to be known as the Municipal Section.

A paper on "High-pressure Water Service for Fire Protection" was presented by J. B. Sando. The three systems, by gravity, by pumping from fire boats, and by pumping from permanent stations were described by means of typical installations of each. The plants taken up in this way included those at Newark, N. J.; Providence, R. I.; Milwaukee, Wis.; Baltimore, Md.; Philadelphia, Pa.; Coney Island, N. Y.; San Francisco, Cal.; New York, N. Y.; Niagara Falls, N. Y.; Spokane, Wash. Mr. Sando showed a large number of lantern slides of the electrically driven pumps at New York, Niagara Falls and Spokane. In each case the installation of the high-pressure service has decidedly facilitated fire-fighting and resulted in a material decrease in insurance rates.

Electrically Operated Safe Factory.

The Davis Safe and Lock Company, of Portland, Ore., which has recently completed large extensions to its plant, operates all of its larger machines by individual electric motor drive. A transformer station on the company's premises steps down electric power at 11,000 volts to a working pressure of 220 volts. Electric drive is used throughout the entire factory.

LIGHTNING PROTECTION.[1]

BY WALTER M. PETTY.

The question for lightning protection for fire-alarm and police-signal circuits is one that is of more or less interest to us all. I say more or less because to those fortunate ones whose wires and cables are all underground, the necessity for protection is much less than to the others who have combinations of aerial and underground wires, and still others who have nothing but aerial wires.

In a paper read by me before this Association some years ago, I went into this question somewhat elaborately and while feeling that great progress has been made since that time in all classes of construction, I still am of the opinion, based on experience, that some of the protective devices mentioned in that paper are still effective. It should be borne in mind that the actual danger of lightning is very remote. It may not be generally known, but statistics prove, that when it comes to human life but two persons in every million are killed by lightning, and the actual damage done to property throughout this country is comparatively very small indeed. The same proportion holds good, as I previously remarked, with regard to the lines that are actually struck. All of us know of the enormous energy of a lightning flash or discharge and with our knowledge of the inductive influences of both static and dynamic electricity in the neighborhood, it is reasonable to suppose that wherever a lightning discharge occurs, with its enormous potential and current, everywhere in the neighborhood on every conductor will be induced current of more or less quantity according to the conditions of the circuit. If this current is of such magnitude as to injure the apparatus in the circuit—and of course the apparatus of fire-alarm and police-telegraph systems is in the majority of cases liable to be so injured—then comes the necessity of protection.

The best and ideal method, and, like all ideal things, impossible to attain, is to have our lines permanently grounded; that is, to keep them at the same potential as the earth; then an inductive discharge passing into the ground will do no damage but, of course, we know this is an impossibility.

The next best thing is to provide a ground connection with some sort of an air-gap between the lines and the earth. About this air-gap there is a difference of opinion, some authorities making it very small and others larger. The reason for this is that, besides dealing with the inductive discharge caused by lightning, we now have the possibilities of currents from other sources which under ordinary conditions are not dangerous, but which may follow on to our lines and cause as much damage as the lightning or inductive discharge itself. We therefore have not only to provide air-gaps of sufficient size, but also some sort of protective devices so that, in the event of high-tension currents reaching our lines, the circuit will be open and no damage result.

The Underwriters' National Electrical Association has prepared, in the National Electrical Code, rules that cover protective devices for signaling systems. Of course it is intended that these rules shall be general in character and the manufacturers of fire-alarm and other apparatus carrying small currents, have devised many schemes to comply with them. It is not my intention in this paper to mention any particular one of these devices. I would refer those interested to my previous paper on the subject, and also to the many manufacturers, especially of telephone apparatus, who have put the devices on the market.

I cannot pass this subject without speaking of apparatus which is not covered by the Code. I refer particularly to fire-alarm and police boxes, which, being placed out of doors and seldom if ever protected by insurance policies, do not come strictly under the jurisdiction of the Underwriters' National Electrical Association. There has been in days gone by much discussion as to the advisability of grounding these boxes. The writer was at one time opposed to this, but, like many a better man, he has seen the error of his ways, and now believes that not only is it advisable to ground these boxes for the safety of the public, but also as a precaution against lightning and high-potential currents.

With the old style of boxes using fingers, the danger of welding of these fingers was very great, although to a certain extent they were protected by the nongrounding of the boxes. But with the modern cut-out devices installed in the boxes, together with the new types of brake wheels, this danger of welding the parts is very remote and, in fact, it is hardly necessary to be considered. On the other hand, if the box is not grounded, there is always great danger of a static charge seriously injuring anyone who attempts to open the door. The writer is of the opinion that the most important part of a fire-alarm or a police-telegraph system is the box, and too great precaution cannot be adopted to protect this in every way.

As mentioned in his previous paper, he has installed over every box a lightning-arrester composed of five cylinders of nonarcing metal, spaced about one-sixteenth of an inch apart, the center one of which is grounded and the two outer ones are connected to positive and negative legs of the line respectively. Since the installation of this type of arrester eight years ago, he has never had any damage result to his fire-alarm boxes notwithstanding that some of them are still of the finger type.

In discussing this question of lightning protection with some superintendents and also electric light engineers, the question has arisen as to the possible danger to apparatus from high-powered wireless-telegraph stations in the neighborhood. It would be interesting to find out from some of our members, who have boxes in the neighborhood of some of these high-tension stations, whether they had had any trouble. The same protective devices which would be effective in the case of lightning should also be useful under these circumstances.

1 A paper, slightly condensed, read before the fifteenth annual convention of the International Association of Municipal Electricians at Rochester, N. Y., September 7, 1910.

Chicago's Telephones Increase.

The Chicago Telephone Company installed 4,709 new telephones in August and removed 2,339, a net gain of 2,370. For eight months 45,960 instruments were installed, against 39,884 for the same period last year. The total number of telephones in service in Chicago and the suburban district is 285,691, an increase of 14.9 per cent.

Shipments of Electrical Apparatus to the Philippines.

During the past year electrical machinery and appliances valued at $241,097 was shipped from the United States to the Philippine Islands. This exceeds those for the previous year by $58,673.

HOW TO DESIGN A CONSTANT-POTENTIAL DIRECT-CURRENT DYNAMO.—II.

BY W. T. RYAN.

The ohms per square inch of brush contactt may be obtained from Table XI.

$$R_b = \frac{R'_b}{A_b} \qquad (35)$$

where R_b=resistance of one set of positive and one set of negative brushes in series.

A_b = area in square inches of the brushes in one set.

The drop in voltage due to the brush contact resistance will be:

$$E_b = 2 R_b I'_a \qquad (36)$$

where E_b = drop due to brush contact.

I'_a = current per path.

where I_a = total armature current.

W'_b = watts lost in brush contact resistance.

$$W'_f = \frac{746\, b'\, A_b'\, \pi\, D_c\, q\, r}{12 \times 33000} \qquad (39)$$

$$W_b = W_b' + W'_f \qquad (40)$$

where W'_f = loss in watts due to brush friction.

b' = brush pressure in pounds per square inch. (Varies from 1 to 3. 1.5 is a good value.)

A'_b = total contact area of the brushes.

D_c = diameter of the commutator in inches.

q = coefficient of friction. (0.3 is a fair value for carbon brushes.)

W_b = total brush loss in watts.

sents the losses between the commutator connections and the terminals of the machine, not including the series windings.

The temperature rise of the commutator in degrees centigrade above the air will be:

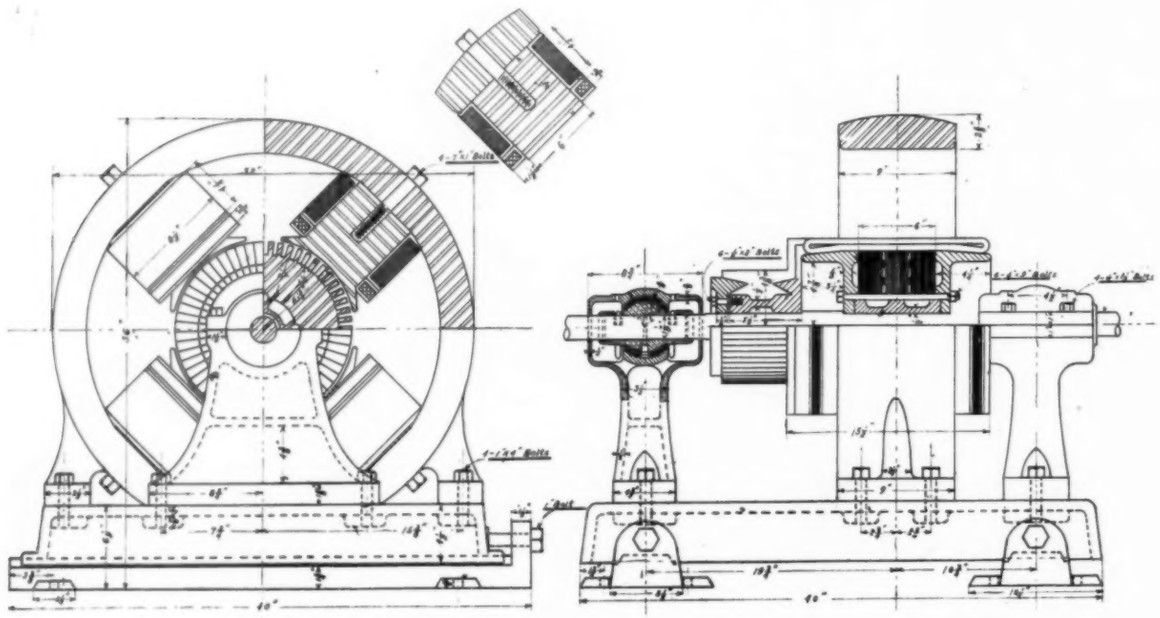
$$T_c = \frac{W_b}{S_c}\, t_c \qquad (41)$$

where S_c=radiating surface of the commutator in square inches.

t_c = rise of temperature per unit of specific power. (See Table XII.)

If the temperature rise exceeds fifty-five degrees centigrade for continuous operation at normal load, the radiating surface should be increased either by increasing the outside diameter, by making the commutator hub hollow, or increasing the length.

(*K*) *Reactance Voltage.*—A large



ELEVATIONS AND SECTIONS OF A TWENTY-KILOWATT DIRECT-CURRENT DYNAMO.
130 Volts, 800 Revolutions per Minute.

The resistance between the commutator and the terminals of the machine will be (not including the series field and neglecting the lead wires which offer practically no resistance):

$$R''_b = \frac{2 R_b}{s} \qquad (37)$$

where s=number of "sets" of brushes.

R''_b = total brush-contact resistance (practically is the resistance from the commutator to armature terminals).

The I^2R loss in the brush contacts will then be:

$$W'_b = I^2_a R''_b \qquad (38)$$

TABLE XI.
BRUSH CONTACT RESISTANCE.

Pounds per square inch.	Ohms per square inch of two brush contacts when current density is 30 amperes per square inch=R'_b
0.6	0.086
0.8	0.078
1.0	0.071
1.2	0.066
1.4	0.062
1.5	0.060
1.6	0.058
1.8	0.056
2.0	0.053
2.4	0.050
2.8	0.049
3.0	0.049

So much copper has to be provided to make the commutator wear well that the I^2R losses in the commutator are negligible. W_b therefore practically repre-

number of experiments by Hobart on a number of machines showed that an armature coil in the point of the field in which it is ordinarily commutated will set up an average of twenty maxwells per ampere-turn per inch of gross length of the armature core.

$$\phi_r = 40\, n\, t\, L \qquad (42)$$

where ϕ_r = total flux set up by the short-circuited coils, per ampere.

n = number of coils short-circuited by one brush.

t = number of turns per coil.

L = length of armature core in inches.

The factor 2 is inserted because there are two coils appearing in the same slot short-circuited by adjacent brushes at the same instant, and the flux set up by both is linked by the turns of either.

The inductance, h, in henries, of the short-circuited coils will then be,

$$h = \frac{\phi_r}{10^8} \qquad (43)$$

The time during which a reversal takes place is that required for one commutator segment to pass under a brush and is,

$$T = \frac{60 W_c}{\pi D_c r} \qquad (44)$$

where T = time of commutation.
W_c = circumferential width of a brush in inches.
D_c = diameter of commutator in inches.

TABLE XII.
SPECIFIC TEMPERATURE RISE OF COMMUTATORS.

Average peripheral velocity of S_c in feet per minute.	Rise of temperature per unit specific power loss in degrees centigrade = t_c.
600	77
900	71
1,200	64
1,500	61
1,800	58
2,100	56
2,400	55
3,000	54
3,600	53

Two reversals are required to make a cycle, hence the frequency of commutation, f_c, is

$$f_c = \frac{1}{2T} \qquad (45)$$

where f_c = frequency of commutation in cycles per second.

The reactance voltage will then be

$$E_r = 2\pi f_c h I'_a \qquad (46)$$

where E_r = reactance voltage,
h = inductance in henries,
I'_a = current per path in the armature in amperes.

This should not be more than two-thirds the average voltage developed between commutator segments. In case E_r comes out too high it is usually lowered by decreasing the number of turns between segments.

(L) Diameter of Shaft.—The diameter of the shaft within the core may be found by the formula,

$$D'_c = K_1 \sqrt[4]{\frac{W}{r}} \qquad (47)$$

where W = output of the machine in watts.
K_1 = constant depending on the output of the machine. (See Table XIII.)

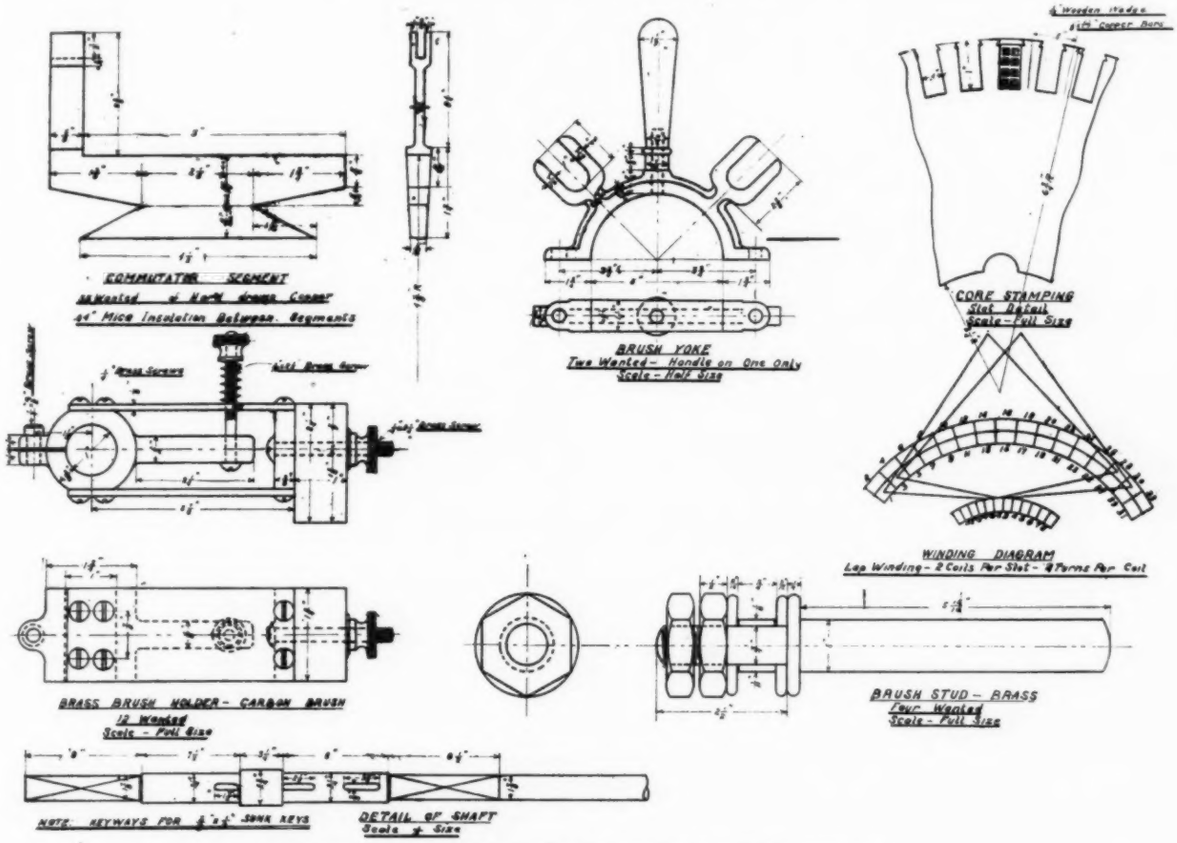
The diameter of the bearing portion of the shaft may be obtained from the formula:

$$D_b = 0.8 K_1 \sqrt[4]{\frac{W}{r}} \qquad (48)$$

where D_b = diameter of the bearing portion of the shaft in inches.

TABLE XIII.
SHAFT CONSTANTS.

Capacity in Kilowatts.	K_1
1	0.9
5	1.0
10	1.1
50	1.2
100	1.3
200	1.4
500	1.5
1,000	1.6


COMMUTATOR SEGMENT
BRUSH YOKE
Two Wanted – Handle on One Only
Scale – Half Size
CORE STAMPING
Slot Detail
Scale – Full Size
WINDING DIAGRAM
Lap Winding – 2 Coils Per Slot – 4 Turns Per Coil
BRASS BRUSH HOLDER – CARBON BRUSH
12 Wanted
Scale – Full Size
BRUSH STUD – BRASS
Four Wanted
Scale – Full Size
NOTE: KEYWAYS FOR ¼" x ¼" SQUARE KEYS
DETAIL OF SHAFT
Scale ¼ Size

DETAILS OF TWENTY-KILOWATT DIRECT-CURRENT DYNAMO.

The length of the bearing may be found from the formula:

$$L_b = K_2 D_b \sqrt{r} \qquad (49)$$

where L_b = length of the wearing portion of the bearing in inches.
K_2 = constant (see Table XIV).

TABLE XIV. (Esterline.)

Capacity in Kilowatts.	K_2 High Speed.	K_2 Low Speed.
1	0.075	0.100
5	0.100	0.150
10	0.115	0.175
50	0.125	0.200
100	0.150	0.225
1,000	0.200	0.275

(M) Dimensions of Pole Core.—If ϕ is the flux in the air gap under one pole at

no load, the corresponding full-load value of the flux in the pole core will be:

$$\phi' = \phi^{\lambda} \quad (50)$$

where λ = leakage coefficient. (See Table XV.)

TABLE XV. (Esterline.)
LEAKAGE COEFFICIENTS FOR MULTIPOLAR FIELDS.

Capacity in Kilowatts.	Leakage Coefficient.
1	1.35
2	1.25
5	1.20
10	1.16
25	1.15
50	1.14
100	1.12
500	1.09
1,000	1.08

$$A_p = \frac{\phi'}{B_p} \quad (51)$$

where A_p = area of pole core.
B_p = magnetic density in the core.

If the breadth, W (see Fig. 1), is made equal to the length of the armature, which accords with usual practice, the width, W', will be:

$$W' = \frac{A_p}{W} \quad (52)$$

This formula applies to a rectangular pole core. If a round pole core is used the diameter should be made, as nearly as possible, equal to the length of the armature core. In any case the pole shoe, if there be one, should be as wide as the armature core is long and should not be less than approximately sixty per cent, nor more than approximately eighty per cent, of the circumference of the armature.

If the core is laminated, an allowance of about ten per cent should be made for the insulation between the laminations. If sheet steel or wrought iron is used in the pole core, the magnetic density should ordinarily be from 85,000 to 90,000 maxwells per square inch. If cast-iron poles are employed, a magnetic density of from 45,000 to 50,000 maxwells per square inch is usually about right.

(*N*) *Length of Pole Core.*—It must be sufficiently long to allow for radiation and for the accommodation of the windings. A certain percentage field current was assumed in accordance with Table IX.

$$W_s = W \times \text{per cent shunt-field current assumed.} \quad (53)$$

where W_s = shunt-field loss in watts.
W = capacity of the machine in watts.

$$W' = \frac{W_s}{p} \quad (54)$$

where p = number of poles.
W'_s = shunt-field loss per pole.

$$S_p = \frac{W_s}{t_p} \quad (55)$$

where S_p = number of square inches of pole-core surface under the shunt field winding.
t_p = specific temperature constant for the shunt field. (This will vary from 1 to 1.5. 1.25 is a fair value.)

Equation (55) is given for the purpose of obtaining an approximate solution in order that the design may be proceeded with. When the dimensions of the shunt-field coil have finally been determined they should be checked up for temperature rise by equation 56, which is based on Timmerman's experiments at Cornell University.[1]

$$T_s = \frac{83\ W_s'}{S_s} \quad (56)$$

where T_s = temperature rise of the shunt field coil in degrees centigrade.
W'_s = loss per pole in watts.
S_s = total radiating surface of the coil in square inches.

T_s should not exceed forty degrees centigrade. If the temperature rise is very much over forty degrees it will be necessary to redesign the coil.

$$L_p = \frac{S_p}{P_p} \quad (57)$$

where L_p = length of pole core for shunt-field winding only.
P_p = perimeter of pole core in inches.

Again, in order to proceed with the design add a percentage to L_p in order to get an actual length of pole core. For a shunt-wound machine add about ten per cent. If the machine is to be overcompounded ten per cent, add, say, forty per cent, and for other percentages of compounding in proportion. Equation (56) may also be used to get the temperature rise of the series field. A little higher temperature rise may be allowed in the series field than in the shunt field, since it carries full load current only when the machine is carrying full load. It should not exceed fifty degrees centigrade.

If the space available for the windings proves to be either too large or too small the above length will have to be adjusted accordingly.

(To be continued.)

The Tauern tunnel, in Austria, will be ventilated by an electrical equipment invented by an Italian engineer. The installation, which is nearly completed, utilizes electric fans.

1Transactions American Institute of Electrical Engineers X, p. 342.

Western Electric Company Plans Enlargement.

The business of the Western Electric Company for August showed an increase of fifty per cent over the corresponding month in 1909, says the *Wall Street Journal.* The probable showing of $61,000,000 for the present year is exceeded only by 1906, with gross sales of somewhat more than $69,000,000. It is of interest to note that the nature of the company's business has changed markedly in three years. In the latter part of 1907 the Western Electric Company broadened its policy with the result that instead of being confined to the twenty-five associated Bell companies its business is distributed among more than 7,000 telephone companies, as well as many thousands of customers for electrical supplies and apparatus. In 1906, and prior thereto, a large part of the Western Electric's business was with large telephone exchanges. The trend of the business at the present time is best shown by the fact that in the last twenty months more than a quarter of a million of rural telephones have been distributed.

This year's business will be divided among approximately 800,000 orders, as compared with 475,000 in 1906, with an average value per order of $71 for 1910, as compared with average value of $145 per order in 1906. In other words, more than twice the number of orders had to be handled for the same amount of business. Export business is showing gratifying increases.

On the Western Electric's payroll there are at present 23,000 persons. In order to provide adequate manufacturing facilities for the future, it is now planned to erect further extensions to the buildings at Hawthorne.

A Rich Scientific Society in Moscow.

At Moscow, Russia, there has recently been organized the Christoph Ledenzow Society for the Advancement of Experimental Sciences and Their Practical Application. Its founder, Christoph Ledenzow, left it an endowment of two million rubles ($1,030,000). The society will conduct research work in conjunction with the Imperial University of Moscow and the Imperial Technical High School of Moscow. It will also aid independent investigators and inventors and test the value of scientific and technical inventions and improvements.

MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

BY JOHN B. C. KERSHAW.

The British Association for the Advancement of Science has met only once before in the great center of the English steel and cutlery industry, and thirty-one years have elapsed since Sheffield was visited by the Association. The city has increased greatly in population and in importance during the intervening period. It is a curious fact that the Association itself can point to no similar growth, and that the number attending the Sheffield meeting of 1910, is but little larger than that which attended the meeting of 1879.

Professor Bonney's presidential address dealt as might have been expected with a geological subject, namely, the various theories of glacier action which have been put forward to explain the present geological formation and structure of the British Isles.

The papers and discussions with which it is proposed to deal in this article, were distributed among several of the sections into which the Association is divided for the purposes of work, and no attempt will be made therefore to give a detailed account of the papers or discussions in any one section of the meeting.

BRITISH RAILWAYS. SOME FACTS AND A FEW PROBLEMS.

This was the title of Professor Dalby's address before the Engineering Section of the Association. This address was crowded with figures and diagrams relating to the working costs of railways, and with energy curves based on working tests of locomotive boilers, made at the St. Louis Exposition. An abstract of the electrical features follows:

The electropneumatic system has found most favor in England up to the present time. The equipment installed includes such notable stations as the Central at Newcastle with 494 levers, and the Glasgow Central with 374 levers, and the whole of the Metropolitan District system of underground railways. In this system an air cylinder is connected to each set of points and to each signal arm. Air compressed to sixty-five pounds per square inch is supplied to the cylinders from a main running alongside the railway kept charged by small air compressors placed at convenient intervals. Each air cylinder is provided with a small three-way air-valve operated by an electromagnet. The movement of each air-valve is controlled electrically from the cabin through the electromagnet associated with it. The system grouped round any one signal cabin may be regarded as an engine fitted with a large number of cylinders, each working intermittently by compressed air, and where in each the valve rod has been changed to an electric cable, all the cables being led to a signal cabin where the operation of the valves is done by means of an apparatus which is as easily played upon as a piano, with this difference, however, that the notes are mechanically interlocked so that a signalman cannot play any tune he pleases, but only a tune which permits of safe traffic movement. Moreover, the instrument is so arranged that the movement of the small lever determining the movement of a signal arm cannot be completed unless the signal arm actually responds to the intention of the signalman, thus detecting any fault in the connections between the box and the arm.

The obvious advantage of power signaling is the large reduction of physical labor required from the signalman. His energy can be utilized in thinking about the traffic movements rather than in hauling all day at signal levers. One man at a power frame can do the work of three at the ordinary frame. The claims made for power signaling, in addition to the obvious advantage of the reduction of labor, are briefly that the volume of traffic can be dealt with is largely increased, that the area of ground required for the installation is considerably less than with the ordinary system, with its rodding, bell-crank levers, chains, and pulleys, and that where the conditions are such that power signaling is justified the maintenance cost is less than with a corresponding system of normal equipment.

Several of the power-signaling installations are automatic in the sense that between signal cabins on stretches of line where there are no junctions or crossover roads requiring the movement of points, the movement of the signal arm protecting a section is determined by the passage of the train itself. The most important equipment of this kind is that installed on the group of railways forming the "Underground" system.

The speed at which traffic can be operated by this system of power signaling is remarkable. At Earl's Court junction box forty trains an hour can be passed each way—that is eighty per hour—handled by the one signalman in the box. As the train approaches the box its approach to the section and its destination must be notified to the signalman. When it is remembered that with ordinary signaling, to take an express train for example, a signalman hears some twenty-four beats on the gongs in his box, and sends signals to the front and rear box which give altogether some twenty-four beats on the gongs in these two boxes, forty-eight definite signals in all, for every express train he passes into the section which his signals protect, it will be understood that the system must be profoundly modified to admit such a speed of operation as eighty trains per hour per man. The modification is radical. No gong signals are used at all. There is a small cast-iron box standing opposite the signalman with fifteen small windows in it, each about one and one-half inches square. Normally each window frames a white background. A click in the box announces the approach of a train, and a tablet appears in one of the empty windows showing by code the destination of the train. The signalman presses a plug in the box, a click is heard, and a tablet is seen in a precisely similar apparatus in the next box. When the train passes the man presses another plug and the tablet disappears.

Four wires run between the signal boxes along the railway, and by combining the currents along the four wires in various ways fifteen definite signals can be obtained, a number sufficient for the District traffic. Each of the fifteen combinations is arranged to operate one particular tablet in the box. Current from these four wires is tapped off at intermediate stations and is used to work a train indicator showing the passengers assembled on the platform the destinations of the next three trains. The whole equipment is a triumph of ingenuity and engineering skill, and is a splendid example of the way electricity may be used to improve the railway service quite apart from its main use in connection with the actual driving of the trains.

THE PRICE OF ELECTRICITY.

A paper on this subject was read by Edward W. Cowan before the members of the Economic Section, and excited a keen discussion, in which S. L. Pearce, chief electrical engineer of the Manchester Corporation, W. B. Woodhouse, of the Yorkshire Power Company, and others joined.

Mr. Cowan, in his paper, criticized the principles of charging employed by most of the English electrical supply companies, and advocated a change in the system.

A fundamental principle which the industry has established was that of charging upon the basis of equal rate of profit from every class of consumer. This system had many advantages from a bookkeeping point of view, and was a safe system which was also comparatively simple to administer.

But the author argued that the equal-profit system failed in the attainment of the best economic results, because the factor of demand was ignored in such a system. The demand for electricity was of a composite character. It was a demand for light, power, heat, etc. The intensity of demand as between these various uses of electricity would be different; that for light generally being greater than that for power, at a given price, and so on. As it would be admitted that the greatest economic advantage would be realized when there was the closest and widest possible correspondence between the incidence of supply and the incidence of demand, it must follow that adjustment of price of supply according to the intensity of demand in the case of each class would secure a more efficient correspondence, and consequently a greater aggregate economic advantage. The difficulties in giving effect to a practical system of classified tariffs were discussed, and it was shown by reference to the successful operation of the system in railway working and in other industries that these difficulties were not insurmountable. It was also shown that electricity production for public supply was of the nature of a joint production, and it was argued that, in so far as it was of that character, no separate part of the supply could be regarded as having a separate calculable cost. Examples were given in other industries of apparent anomalies in the separate prices of the component parts of a joint supply. It was shown that these prices, as to their relation to each other, were influenced by the intensity of demand for each part of the joint production, and the impossibility of ignoring this influence without great economic loss was pointed out.

The author contended that, when the conditions were analyzed, it was found that there were no grounds for such a view, but that, from an ethical standpoint, classification might be resorted to without any injury or loss to any class. The gain due to such a method was shown not to be a differential gain, but a specific gain which might be shared by all classes of consumers. Further, it was shown that the equal-profit system cannot be entirely justified from the ethical point of view, because certain in-

jurious results might accompany its working; and the fact that the measure of advantage was arbitrarily restricted by the system could scarcely be justified, unless the practical difficulties of classification were such that its adoption was on that account undesirable.

The effect of a classified tariff was shown, and, under the conditions taken (a price of 2.0 for electricity for light use, 0.8 for power use, and 0.6 for heating use), it was found that the aggregate demand was increased from 2.7 to 6.0, and the mean price per unit reduced from 2.0 to 1.13, with the same percentage of profit. This diagram did not pretend to represent actual conditions, but it was presented for the purpose of demonstrating the operation of the principle of classification.

The paper concluded with a reference to the practical importance of the question at issue. It was pointed out that there was an immense potential demand for electricity for power and domestic heating and refrigeration, which could be rendered active by the sufficient lowering of price.

Without attempting to measure the practical effects of a wise classification of tariffs, the author claimed that if any economy could be realized by the system, it was not right to ignore it or to condemn it upon insufficient grounds. Though the economy might not be great, small price changes sometimes effected great alterations in the volume and channels of trade.

A NEW METHOD FOR PRODUCING HIGH-TENSION DISCHARGES.

Prof. E. Wilson and W. H. Wilson contributed a short paper on this subject, of which the following is an abstract:

Energy is taken from an alternating or continuous-current source and stored in a magnetic field by an inductance; it is then permitted to surge into a condenser, which forms with the inductance a low-frequency oscillatory circuit. When the energy is accumulated in the condenser the latter is mechanically bridged across the primary winding of an induction coil, with which it forms a high-frequency oscillatory circuit. The energy is then transmitted by the secondary winding of the induction coil to the work circuit, and can be of an oscillatory or unidirectional character, according to the purpose in view. The apparatus is light, efficient, and cheap, and is especially suitable for radiotelegraphy, X-ray, and other work, in which high-tension electricity is employed.

FERRO-SILICON AND THE SPECIAL DANGERS ARISING FROM ITS STORAGE AND TRANSPORT.

An important paper on this subject was contributed to the Chemical Section of the Association by Dr. S. M. Copeman.

The author stated that the possibility of danger to life from the transport of ferro-silicon (an alloy or eutectic mixture of iron and silicon employed in the manufacture of steel) had already received official attention in the United Kingdom through a "Notice to Shipowners, Shipmasters, and Shippers" issued by the Board of Trade in September, 1907. Among the accidents known to have occurred from the handling or transport of ferro-silicon might be mentioned the explosion of consignments inclosed in iron drums, the ferro-silicon in which contained about fifty-four or fifty-five per cent of silicon. But more important and much more frequent than these were the well-authenticated cases of sudden illness and death caused by the gases evolved from certain cargoes of ferro-silicon, full details of which were set out in an official report recently presented to both Houses of Parliament.

Low-grade ferro-silicon, that is, an alloy containing not more than fifteen per cent of silicon, has been made in blast furnaces to a considerable extent in Great Britain, but the high-grade variety, containing from twenty-five to ninety-five per cent of silicon, could only be produced at the high temperature attainable in the electric furnace. The latter variety was imported from certain districts in France, and, to a less extent, from Austria, Scandinavia, etc., where ample electrical energy is derivable at a low cost from water power. About 4,000 tons of this material were said to be imported annually into England, and as serious inconvenience to steel manufacturers was being caused by the refusal of shipping firms to carry it, there was great need for regulations permitting its transport under defined conditions which would obviate accident.

The recommendations suggested by the author, and now officially adopted by the Board of Trade, would probably prevent the occurrence of future accidents in the transport of ferro-silicon. They comprise (1) the need for ascertaining that the ferro-silicon has been broken into pieces of the size in which it is usually sold some time before being taken on board ship; (2) the marking in bold letters of the certified percentage grade of each consignment on the barrel or other receptacle, and the date of manufacture; (3) the prohibition of conveyance of ferro-silicon on passenger vessels; and (4) the adoption of certain precautions during transport in cargo boats.

THE TESTING OF HEAT-INSULATING MATERIALS.

A paper on this subject was presented by Francis Bacon. An abstract follows:

In order to avoid the labor and difficulty of molding the material to be tested into a shell or covering of complicated shape, recourse was had to the more direct "wall" method, in which the drop of temperature between the two faces of a thin slab, transmitting a known heat flux, is determined. The inherent sources of error to which such a simple method is liable are: (1) Leakage of the heat flux; (2) incorrect determination of the temperature of the surfaces. It is claimed that both of these errors have been rendered negligible.

Duplicate specimens of the material to be tested are obtained in the form of slabs measuring 18 by 18 by 1.5 inches. A thin flat heating net of uniformly wound resistance wire, interwoven with asbestos, measuring 12 by 12 inches, is sandwiched in between these slabs, the marginal cracks left all around the heating net being filled up with strips of felt. Direct contact between the heating net and slabs of insulating material is avoided by interposing a thin sheet of asbestos millboard on each side. To measure the temperature of the faces of the slabs, advantage is taken of the fact that there is no perceptible drop of temperature between a heat insulator and a good conductor of heat, in close contact with it. Sheets of zinc (12 by 12 inches) are taken, and a flat resistance coil of fine double silk-covered wire wound uniformly over a central six-inch square of one of their faces. The wire is wound noninductively, and is secured to the zinc plates by stitches of thread passing through fine holes, drilled in the metal. Zinc plates prepared in this way are inserted on each side of the slabs of insulation, the fine wire coils being in direct contact with the material to be tested. Thin wood covers are now put on both sides, and the whole is clamped firmly together by four bolts, with wing nuts passing through two skeleton frames of wood. The apparatus is then hung in a vertical plane in a situation screened from drafts and sunlight. The terminals of the heating net are led away through an adjustable resistance and suitable switchgear, to a battery of accumulators. A voltmeter and ammeter are connected up to the circuit, from the readings of which the watts dissipated can be obtained. As the arrangement of slabs is identical on both sides of the heating net, the heat generated will divide equally, half escaping through one wall and half through the other. The terminals of the resistances of fine copper wire are connected up to a Wheatstone bridge of the stretched-wire type, through a system of plugs, which enables the ratio of resistances of either pair of coils to be determined.

Typical cooling curves for silicated cotton, for "Expansit Schrot," and for an air jacket, obtained by use of this apparatus and method, were given, and the author stated that the values obtained for asbestos led him to the conclusion that its heat-insulating value was rather due to its fireproof qualities, than to its low conductivity for heat, which in fact was no lower than that of wood.

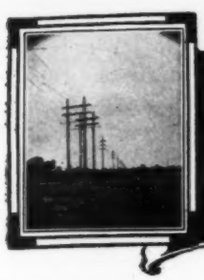
REPORT ON ELECTRO-ANALYTICAL METHODS.

The work on electro-analysis has been further elaborated during the year by the publication of papers (Faraday Society Transactions for 1910) on the "Electrodeposition of Metals," by Dr. F. Mollwo Perkin and W. E. Hughes, and by Dr. H. J. S. Sand on "Apparatus for the Rapid Electro-analytical Separation of Metals," and "The Electrodetermination of Lead as Peroxide."

Perkin and Hughes have devised and experimented with new cathodes for the rapid deposition of metals. One simple, smooth cathode is in the form of an elongated thimble, and with this, when rapidly rotated, very smooth and even deposits can be obtained; the total active electrode surface is about 16.3 square centimeters. Extended work has shown, however, that a platinum-gauze cathode surrounding a spiral anode, which is rapidly rotated, gives the most satisfactory results. For separation of metals by means of graded potentials, a funnel-shaped vessel with a tap for running off the electrolyte is used. This vessel has a side tube fused into it at about the center, to take the capillary of the auxiliary electrode. This form of apparatus gave very good results, and is very simple in working.

The experiments referred to a year ago by Dr. Sand with an anode made partly of glass and a cathode of metals, other than platinum, have been completed by him, and will be published shortly. Satisfactory results for copper were obtained with a cathode of silver, and for zinc with a cathode of nickel. In the former case the electrolyte deposit may be removed from the electrode by a solution of hydrogen peroxide in diluted sulphuric acid.

Experiments on the separation of the four metals, copper, antimony, tin, and lead, have been continued. In connection with this work it has been shown that chlorides exert a retarding influence on the deposition of copper. This is due to the formation of derivatives of cuprous chloride during electrolysis, from which copper is only deposited at a high potential. The conditions for the separation of copper from antimony have been fully worked out, and mixtures of the three metals, copper, antimony, and tin, corresponding to the industrial alloys have been successfully analyzed. When lead is present in small quantity this may be deposited with the tin; the greater part of the tin may afterwards be removed by making the electrode the anode in a solution containing sodium polysulphides. The lead may then be separated from the small quantity of remaining tin by means of nitric acid, and can afterwards be deposited electrolytically.



CENTRAL-STATION PRACTICE

Transmission—Interior Wiring.

ELEMENTS OF POWER-STATION DESIGN.—IV.

THE SELECTION OF PRIME MOVERS.—I.

BY W. B. GUMP.

The proper selection of prime movers for a given set of conditions is by no means an easy task. When the conditions are in a large measure uncertain, as in the case of new power projects, the matter of choosing often becomes most perplexing, and a choice which results in a failure to satisfy the final operating requirements will generally do more to impair the economy of the plant than an unwise choice of any other piece of apparatus.

About a year ago the writer presented a paper before the Los Angeles section of the American Institute of Electrical Engineers entitled "Some Practical Considerations Concerning the Choice of Prime Movers." The object of this paper was to induce a discussion which would throw more light upon the merits of each particular type, namely: (*a*) The Steam Engine. (*b*) The Steam Turbine. (*c*) The Gas Engine.

The result of the discussion which followed failed to bring about a concensus of opinion. Yet a number of facts can be gathered which it is hoped will aid in drawing a conclusion in any particular case.

Steam Engine and Turbine Compared.—At the outset the question naturally resolves itself into a comparison between the steam engine and the steam turbine, this being a subject which has been actively discussed on numerous occasions. The advocate of the reciprocating engine will scarcely admit that the turbine has any advantages, and, in turn, the disciple of the steam turbine is reluctant to recognize any merit in the engine. The choice between these types is therefore bound to remain more or less a matter of personal opinion for some time to come. Notwithstanding the personal element, certain facts relating to each type should be conceded, and, in spite of prejudices, it will be seen that each type possesses certain distinct advantages which cannot be overlooked.

The reciprocating steam engine is destined to operate in factories, mills and pumping plants for many years to come, and cannot in the great majority of such cases be supplanted by the steam turbine. The turbine is particularly well adapted to high-speed direct drive, and its fitness for this sphere of work has been the chief cause for its adoption in electric power stations. A reciprocating unit is more difficult to synchronize, as the action of the governor is much slower. This is on account of the fact that the cut-off is the determining element in regulating the speed. If the load changes after a certain cut-off, the speed cannot be corrected until steam is again admitted. Thus, a more or less serious time element enters into the speed regulation. With engines of the cross-compound or double-compound type, the regulation of speed should be somewhat closer than that of the single-cylinder or tandem engine. Nevertheless, the requirements for proper regulation are not completely satisfied, even though thousands of steam-engine units are daily supplying electrical energy, and are operated in parallel with a large degree of success.

With the steam turbine the problem of speed regulation is more easily solved. Here we have but one moving element which in itself is capable of giving the desired flywheel effect. Being driven by a group of steam jets which may instantly be varied in number or intensity, the regulation permissible is practically as close as the most severe operating conditions could demand. As the steam turbine is essentially a high-speed prime mover, its field has necessarily been more limited than it might be if low speeds could be employed. From the fact that it is a high-speed machine, the reduction in floor space for a given rated capacity is from sixty to eighty per cent below that of a reciprocating unit.

It is undisputed that the steam turbine is the oldest form of heat motor. Admitting this fact, it must be borne in mind that the practical utility of the steam turbine has been realized only within recent years. During this time numerous difficulties have appeared in the commercial working of the turbine, and its development has been at such enormous cost that only a few of the larger manufacturers have been able to install steam turbines on a commercial scale. Many of the weak points which existed during early installations have been eliminated in subsequent machines. A considerable number of faults still remain to be remedied before the turbine is brought to its highest state of development. For this reason it is safe to assume that a steam-turbine plant erected to-day is more likely to be out of date five years hence than a similarly designed reciprocating plant. The many advantages of the turbine, however, and its adoption in most of the larger installations, are testimony to the confidence and the responsibility being given to this form of prime mover.

With respect to steam economy there seems to be some difference, in sizes up to about 500 kilowatts, in favor of the reciprocating engine. The latter type, in the form of a compound four-valve engine, shows on test to operate at a lower steam consumption than a turbine. Above this capacity there is practically no difference up to 1,500 kilowatts, assuming that both types are operated with saturated steam. In sizes exceeding 1,500 kilowatts a difference begins to show itself in favor of the turbine, and in very large units there appears to be but one choice, the turbine, as regards steam economy. The steam consumption of a steam turbine shows comparatively high economy over a wide range of load; in other words, the economy curve is nearly a straight line as compared to the Corliss engine. This is shown in Fig. 1. It can safely be concluded from tests referred to that in units of 2,000 kilowatts or above the steam turbine is

apt to bar the engine from consideration, when other factors which contribute to turbine economy are favorable. One of the factors essential to economical turbine performance is a high vacuum in the condenser. It is an admitted fact that a steam turbine is extremely wasteful when operating against the atmosphere; hence the first requirement for successful turbine operation is high-class auxiliary apparatus. A large quantity of cooling water is necessary to maintain the degree of vacuum required, the cooling water ranging from sixty to ninety times the weight of steam condensed. It is therefore clear that steam turbines cannot be economically considered in localities where large quantities of circulating water cannot be supplied.

The fact that a turbine demands first-class auxiliaries is an item of great importance, since it is possible to increase the maintenance to a point where the commercial economy may be doubtful. This question must therefore be investigated quite thoroughly in the beginning. In units of 2,000 kilowatts or above, the steam turbine will not usually have competition, and should be adopted for electric power service, unless some element of a local nature favors the steam engine beyond any doubt.

The conclusions follow from the foregoing that in units of 2,000 kilowatts or above, the decision should be made to favor the turbine in every case which is normal. Where the units are small—say below 1,500 kilowatts—the question is more difficult to decide, but in most instances where the units exceed 1,000 kilowatts the turbine is still apt to be favorable. This all depends on local conditions. Below 1,000 kilowatts per unit the steam engine should generally be chosen.

Fig. 2 shows the rate of steam consumption using superheated steam for turbines ranging from 100 to 3,000 kilowatts normal output. This includes steam for auxiliaries. The data for this curve were taken from L. G. French's work "Steam Turbines" and were secured from tests made by Hon. Charles A. Parsons. It should be noted that these values are not the maximum economy possible, but are the averages of a large number of tests, and can be expected from turbines which operate under good conditions.

The absence of oil in the exhaust steam is a very favorable feature of the turbine. This means the elimination of oil separators in the main line, and therefore simplifies the piping. The use of steam separators is advisable in both turbine and engine installations. The requirements of the engine in this respect are too well known for comment. With the turbine a steam separator is to be recommended, for two reasons: (1) to prevent sudden inrushes of water with the steam; (2) to eliminate scale-forming elements. The writer has seen the inside portion of the casing of a steam turbine completely coated with hard scale, which was also deposited on the blades to a depth of one-sixteenth of an inch. In the particular case cited the boilers were treated with compound, and this seems to have aggravated priming, which caused particles to be carried with the steam and deposited upon the working parts of the turbine. While the steam separator in this instance did not separate completely, it no doubt made the situation better than could have been realized without a separator. Even with superheated steam the danger of a rush of entrained water is not wholly absent, especially in starting up.

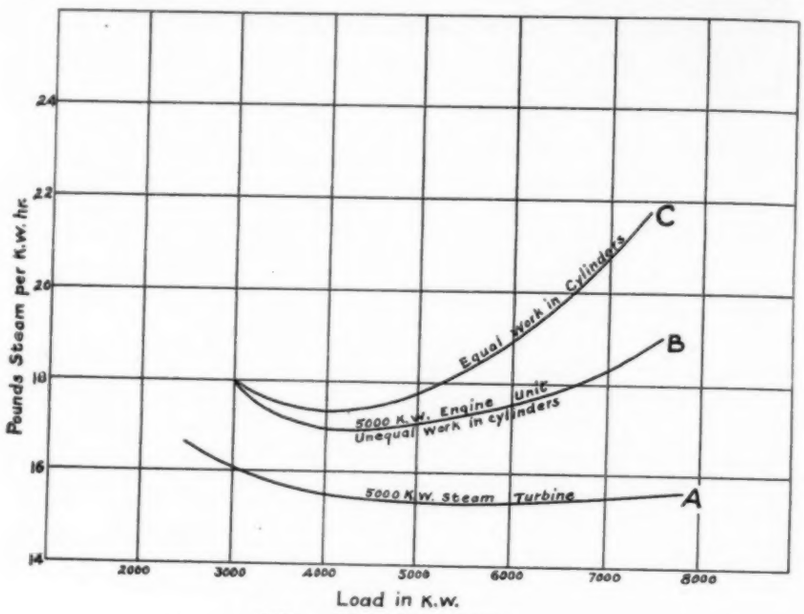


FIG. 1.—ECONOMY CURVES.

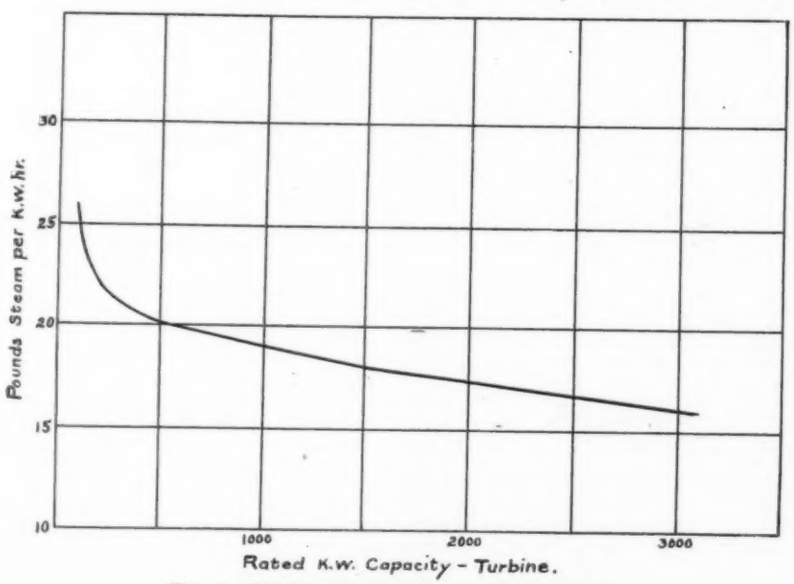


FIG. 2.—STEAM CONSUMPTION FOR TURBINES.

It is well to note that extreme care must be exercised in putting a steam turbine into service. In practice this generally requires more time than the starting of a Corliss engine, on account of several details upon which the successful running of a turbine depends. The first of these details is proper lubrication of the bearings. In the vertical type the demand for proper lubrication of the step bearing is most strenuous, and an interruption to the flow of oil (or water, if it is used) will demand a shut-down in the shortest possible time. With the horizontal type the absence of oil in the bearings is practically as conducive to destruction as in the vertical type, although the effect of dry bearings in the latter does not show itself in the same manner. The next detail is to be certain there is proper clearance between the fixed and movable blades. This demands starting very slowly, and noting the general behavior of the turbine. Any scraping will become evident before the operation has proceeded to any extent.

Auxiliaries.—The auxiliaries should of course be carefully prepared for service and put into operation before the turbine is started. These auxiliaries in the vertical type include: (*a*) Step-bearing pump. (*b*) Oil pump for general lubrication. (*c*) Vacuum pumps. (*d*) Circulating pump. In the horizontal type: (*a*) Lubricating pump. (*b*) Vacuum pumps. (*c*) Circulating pump. An accumulator is sometimes added to the first list of items, on account of the importance of continuous lubrication of the step bearing. In the event of failure of the step-bearing pump the accumulator is automatically put into operation to take care of the emergency until the pump can be started or the unit taken out of commission.

The auxiliaries in connection with the reciprocating engine are not as important as far as continuous service is concerned, but are related almost wholly to steam economy. The distinction between the requirements of the two types of prime mover is therefore obvious.

The statements made relative to speed regulation are evidence of the fact that the steam turbine responds readily to overloads. In fact, no other prime mover has been able to equal the qualities shown by the turbine in this respect. Mr. Stott pointed out this valuable feature in a paper on power-plant economics, presented before the American Institute of Electrical Engineers. It was noted that when in parallel with a reciprocating engine of about the same rated capacity the turbine carried the peaks, while the engine load remained practically constant. The advantage of such a combination in railway service is at once apparent. In this case the turbine has practically the same effect as a storage battery, and is even more ideal in its response to sudden fluctuations.

(To be continued.)

Niagara Power in Canada.

Consul A. G. Seyfert, Owen Sound, Ontario, writes that the construction of the hydroelectric power-transmission lines from Niagara Falls westward to the different municipalities in Ontario is being pushed with speed. There will be over 3,000 miles of cable in use, over 800 miles of which has already been put in place, extending 60 miles to Dundas.

Dundas will be the center for distributing the power to the different places north and westward. From Dundas thirty-five miles to Berlin six cables will be strung. By October 1 it is expected to have the line completed 115 miles west to Stratford. The difficulties in the construction seems to be in securing electrical workers who can endure the arduous work of climbing the tower cross-plates, three-eighths of an inch in thickness.

An Amusing Meter Experience.

In "The Story of Sunbury Station," an account of the Edison experimental lighting station erected at Sunbury, Pa., in 1883, and entertainingly told by W. S. Andrews in the current issue of *Popular Electricity*, an amusing instance of a faked meter bill is recounted by the author.

The meters were of the old-style Edison type wherein the current is measured by the loss in weight of one of the two zinc plates by electrolytic action. At the end of the first month, the meter plates were collected and weighed, and the bills were calculated from the loss in weight of one plate. Most of the amounts thus made out came very close to the estimated figures, but a meter in a large clothing store indicated that about $200 worth of current had been used. As this was an impossible amount, a bill based on a moderate estimate was sent in. The meterman spent several anxious days and nights trying to think out where the mistake had occurred, for Mr. Edison had firmly imbued him with the belief that the meter was infallible. At length it suddenly dawned upon him that he had weighed the meter plates to a tenth of a milligram at the station, but on arrival at the clothing store he found that the copper wires connected to the plates were too long to go into the meter case, so, without any thought as to the consequences, he just clipped off an inch or two of copper wire, which represented about $150 worth or more of electricity when measured by loss of weight. Moreover, he found the pieces of copper wire that he had cut off, and on weighing them up and making proper allowance he found that the faked bill that had been presented was not far from being correct.

Power Project in India.

The Bombay correspondent of the London *Times* states that an Indian company is being formed for the generation of electricity by water storage at Lanauli, in the Western Ghats, for transmission to mills and factories at Bombay. The company is to have a capital of 170 lakhs of rupees (£1,133,320), seventy per cent of which has been already subscribed. The scheme is to furnish 30,000 horsepower, with a reserve of 10,000 and possibilities of expansion to 50,000. The issue is under the auspices of the Tata firm, the owners of the Tata Ironworks.

A Subsidized Central Station.

The town of Lessberg, in Hesse, Germany, has decided on a somewhat novel scheme in regard to the $1,000,000 central electric-generating station soon to be erected in that municipality. The capital stock will be sold in shares of $250 each, and the province of Oberhessen will guarantee a dividend of not less than three per cent and not more than five per cent. All net earnings over this latter figure will be devoted to general public purposes.

Electricity in Klondike.

An English concern engaged in mining coal is constructing a 10,000-horsepower electric plant for the purpose of supplying Dawson and other towns with heat and light, as well as furnishing power to dredges, etc., within a radius of 75 to 100 miles of the plant.

CENTRAL-STATION ECONOMY.—II.

BOILER-ROOM ECONOMY.

BY P. E. MATTESON.

Although considerable saving can be effected by care in the purchase of fuel, unless equal care be exercised in the use of fuel, under the boiler, there might result a loss which would more than offset the saving wrought by careful buying. The object of this article is, therefore, to point out the mistakes in the use of coal, and the remedies therefor.

The heat in coal is extracted by means of combustion. Combustion is the chemical union of combustible matter with oxygen. A clear understanding of the union of the combustible gases in coal with oxygen is essential to comprehend fully its relation to economical fuel consumption.

The most important element in coal, from a heating standpoint, is carbon, but carbon, unless mixed with oxygen, has no heating value whatever. From chemical formulas we learn that carbon reaches the highest heating value when in the shape of carbon dioxide, that is, when each atom of carbon is supplied with two atoms of oxygen in the presence of heat.

To clearly define carbon dioxide we must resort to figures. The combining weight of carbon is twelve, while the combining weight of oxygen is sixteen, so for each twelve pounds of carbon to be burned we must supply thirty-two pounds of oxygen. If only one atom of oxygen be supplied to each atom of carbon, or if only sixteen pounds of oxygen be supplied to each twelve pounds of carbon, the result would be carbon monoxide. One pound of carbon dioxide has a heat value of 14,600 British thermal units, while one pound of carbon monoxide has a heat value of only 4,500 units. As this difference of 10,000 British thermal units is entirely the result of oxygen supply, we can clearly see the importance of sufficient oxygen in combustion.

We obtain our oxygen from the atmosphere, and as atmosphere contains only about twenty-three per cent oxygen (about seventy-seven per cent nitrogen, etc.), we must supply $2.67 \times 100/23 = 11.6$ pounds of air to each pound of carbon consumed into carbon dioxide.

Coal contains from fifty to ninety-five per cent carbon, and as oxygen is necessary for combustion only in proportion to the amount of carbon to be consumed, it is quite evident that the regulation of the air supply is very important to complete combustion, which also means the economical combustion of coal.

This supply of oxygen is of course regulated by the drafts, but in the majority of steam plants the fireman, through a lack of knowledge of the principles of combustion, is liable not to use the drafts to the best advantage. He usually opens the drafts when the steam is low, only to close them again when the boiler blows off. The result of this practice is that the fireman supplies sufficient oxygen, when the steam is low, to make carbon dioxide, but when the steam is up where he wishes it to be he closes the drafts and reduces the supply of oxygen to the rate of carbon monoxide and wastes coal.

An economical fire is one in which the bed of coals is of sufficient depth to maintain a constant heat with few changes of draft. This condition is best produced by the mechanical stoker. The success of these machines lies solely in the fact that they can contemplate a fixed fire depth and draft.

In the steam plant where mechanical stokers cannot be adapted, the fireman can be greatly assisted in his efforts toward proper combustion by a carbon-dioxide indicator. These instruments register the condition of the gases in the firebox and can be attached to the furnace so as automatically to open and close drafts when necessary.

Another thing to be guarded against in combustion is too great an air supply. This condition is a great deal more difficult to detect than insufficient air supply, but the effect is nearly as bad. We must consider that the temperature of air supplied to boilers is seldom over seventy degrees Fahrenheit, while the temperature within the firebox is at least 2,500 degrees. As the specific heat of air is about 0.25, this difference of 2,400 degrees would result in a loss of not less than 600 British thermal units for each pound of air heated to this temperature. Of course, this waste cannot be wholly avoided, because some air is necessary.

Another effect of over-abundant air supply is cooling of the gases. These gases when liberated are about firebox temperature, 2,500 degrees Fahrenheit, and that temperature is necessary to combustion. If so much air is driven through the fire to cool these gases below the combining point, or if the gases are too quickly brought into contact with the boiler plates, which have a temperature of about 500 degrees, the result is incomplete combustion.

A very good example of the effect of oxygen upon carbon is the common Welsbach-mantle gas-burner. In these burners light is unsatisfactory until a certain point in the air supply is reached, at which time the light will be the brightest. Additional air supply results in flaming and a loss of heat and incandescence exactly as takes place in the firebox.

In conclusion, I would strongly recommend an automatic stoker or draft regulator.

How Accidents Happen.

A reader of ours sends us an amusing story about a church in a fashionable district of London. The edifice, it appears, was undergoing general repairs, and, as a kind of after-thought an electrician was requested to inspect the electrical fittings. He did so, without meeting very much to alarm him, but when he came to the fuse box, he began to "get warm," as the children say. After fiddling about and gazing in a vacant kind of way, he turned to the ancient verger and demanded: "Who looks after the lamps and the electrical fittings generally?" With a rather nettled air, the old fellow drew himself up and said: "I attend to *everything.*" "Then, my friend," replied the electrician, no doubt thinking that even angels might tire of looking after that particular innocent, "never again replace burnt-out fuses with French nails." And we wonder how "mysterious" accidents happen?—*The Electrical Engineer.*

Power Plant for Car Factory.

The Cameron Car Company will erect a one-story power house, 50 by 50 feet in plan, at its new plant at Attica, Ohio, to which place it is removing its shops from Beverly, Mass.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

Park and Boulevard Lighting in Denver.

Every city has some distinguishing characteristic by which it is known. Denver's is the "City of Lights," but added to this already widely known reputation a newer one seems on the verge of exposing itself. The city of the best lighted parks and boulevards is the name which Denver is now seeking to be sole possessor of, and the possibility of Denver having a copyright on this name seems evident at this time.

TUNGSTEN LIGHTING OF THE ESPLANADES, CITY PARK, DENVER.

Some time ago Henry L. Doherty, president of the Denver Gas and Electric Company, inaugurated a campaign to light every park and boulevard in Denver. The reins of this movement were taken in hand by Denver's progressive mayor and the fruits of his labor reached a climax recently when the City Park esplanade and Speer Boulevard were practically reclaimed by the city and converted into elaborately lighted electric gardens. A total of 26,000 candlepower is divided between these garden spots. One hundred sixty-candlepower tungsten lamps furnish the light for the esplanade and the same number of seven-and-one-half-ampere, series Nernst lamps turn night into day on the driveway. The accompanying views give but an inadequate idea of the beauty of the new lighting.

NEW LIGHTING SYSTEM ON SPEER BOULEVARD, DENVER.

Indianapolis Lighting System Named.

The prize for the best phrase suggestive of Indianapolis' new system of street lighting went to A. D. Kelley, a salesman, who suggested "Broadways and Brightways." Many suggestions were made, among them being "Pearly Light Paths," "Lots-o-Lite," and "Miles of Light." One contestant even ventured "The Electric Smear."

The contest was conducted by the Indianapolis Commercial Club.

Additional Electric Lighting in Philadelphia's Business District.

Philadelphia is rapidly coming forward as one of the best lighted cities in this country. Early this year its principal thoroughfare, Market Street, was provided with a brilliant and ornamental arc-lighting equipment, which attracted the notice of illuminating engineers from all parts of the country. A description of this installation was given in these columns in the issue of February 12, 1910. This original installation along Market Street, between the Delaware River and the City Hall, has created a demand on the part of the merchants on other business streets for a similar street-lighting system.

Thorough co-operation between the city authorities and the Philadelphia Electric Company the system has just been extended and 350 of the new arc lamps were lighted for the first time last week.

By this addition the central business district between the Delaware and Schuylkill Rivers and between Spruce and Vine Streets has its streets illuminated with a brilliant electric system and becomes a model for the lighting of similar districts in our large cities.

The total cost of the installation, including underground mains, ornamental lamp-posts, arc lamps, etc., is above $200,000 and has been borne entirely by the Philadelphia Electric Company, which put in the entire system and furnishes the current on a contract basis.

The new electric lighting system for the center of the city includes central-pole lights in Broad Street between Spruce and Vine Streets, with "isles of

safety'' at their bases for pedestrians. These are of the same construction as the sample standard erected by Chief McLaughlin of the Electric Bureau, several weeks ago at Broad and Walnut Streets, which has been commended not only on account of its convenience to pedestrians and their safety in crossing Broad Street, but also as a permanent regulator of vehicular traffic on that thoroughfare.

Illumination at Mexican Centennial Celebration.

The electrical illumination of Mexico City, Mex., during the present month is said to be one of the most attractive features of the celebration of the centennial anniversary of Mexico's independence. The Mexico Light and Power Company reports that approximately 300,000 additional lights are in use upon the streets and to decorate the exteriors of the different public and business buildings and private residences. The grounds of Chapultepec Castle, the summer home of President Diaz, are a blaze of light. The National Palace, where the offices of the president and his cabinet are situated, is decorated with 30,000 incandescent lights. In addition to these, 100 arc lamps shed their bright rays from different parts of the exterior of the ancient building. The historic Cathedral edifice, situated diagonally opposite the National Palace, is a beautiful picture by night, with its thousands of incandescent lights that mark the outlines of its towers and the various openings. Many of the decorative designs upon the private buildings are unique and beautiful. The present illumination of the city marks a new era in the electrical development of Mexico. D.

Penny-in-the-Slot Public Lighting.

There has recently been considerable discussion, in Paris and elsewhere, on the time of extinguishing street lamps, says the *Illuminating Engineer*, of London. Many small towns are faced by the question whether it is desirable, for the benefit of a few belated individuals, to maintain the public lighting throughout the night. An interesting solution of the difficulty has been provided by a little continental community, and was recently described in a German newspaper.

The road from the boundary of the town of Glogau to the commune of Zarkau, Silesia, which is about a kilometer in length, is provided with nine electric incandescent lamps, which amply light the piece of road. The communal authorities pay for the lighting of these lamps until 10 p. m. After this hour, however, anybody can place a ten-pfennig piece (equal to about 2.4 cents) in either of the two prepayment meters attached to the lamp-posts at each end of the road, when the light will be switched on for twelve minutes—a period sufficient to enable anybody to walk comfortably from one end of the road to the other. The prepayment meter is contained in a small and unobtrusive iron box. A shield is attached explaining the object of the meter; and at 10 p. m. it is lighted by a small lamp. The period which the lamps remain lighted is regulated by clockwork.

Continental Lamp Trust May Dissolve.

According to the *Berliner Börsen-Courier*, there is a possibility of the dissolution of the carbon-filament-lamp trust formed in the year 1903 under the name of the Verkaufsstelle vereinigter Glühlampenfabriken Ges., Berlin. This combination includes firms in Germany, Austria-Hungary, Sweden, Holland, Italy, and Switzerland, and was intended to continue until the year 1914. Among the eighteen members are the Allgemeine Elektricitäts Ges., Siemens & Halske A.-G., and the A.-G. Pintsch. No British firms are included, and the French firms which joined have since fallen out. It is stated that the total sales of the combination have remained fairly constant at 30,000,000 lamps per annum, but that the profits during the last five years have diminished by two-thirds. One cause of the reduction in the profits is stated to be the new taxation which, it will be remembered, is based on the watt consumption, and therefore falls especially heavy on carbon-filament lamps. On account of the possible reduction in prices and numbers sold owing to the competition of the tungsten and other metal-filament lamps, and the large number of firms which are springing up outside the trust, the continuation of the trust seems improbable. As practically all the firms inside the combination are also manufacturing metal-filament lamps, however, an attempt may be made to bring the sale of these also under the control of the trust.—*Electrical Engineering.*

MINOR STREET LIGHTING AT BOSTON.

ELECTRICITY MAKING PROGRESS AGAINST GAS.

In connection with the lighting of the minor streets of Boston proper, electricity is making noteworthy progress in competition with gas. At present the city authorities have under consideration the problem of supplying light at some 12,000 points off the main thoroughfares of the city, the latter having been provided for by the five-year contract signed in the spring of 1909 with the Edison Electric Illuminating Company of Boston, familiarly known as the Boston Edison Company. Considerable confusion has arisen in the public mind, according to press dispatches, concerning the status of Boston street lighting, the opinion being held in some quarters that the 1909 contract is for some reason no longer in effect. Such is by no means the case, and the Boston Edison Company is lighting all the principal streets and squares of the city by means of 6.6-ampere magnetite arcs, with a few flaming arcs in the most conspicuous locations, along exactly the lines determined with so much care last year. The superintendent of streets is now endeavoring to make a contract for minor illumination, and while the amount of money involved is less than the cost of major street lighting, there are few problems which have come before the city authorities in recent months which have occasioned so much study.

Boston street lighting is now handled by two organizations, the Boston Edison Company and the Rising Sun Street Lighting Company. The latter company performs the gas lighting under a contract, which, with many extensions, has run for some twenty-two years. The City buys from the Edison Company a specified illumination of principal streets, and for the service rendered it makes fixed and regular payments, and has no concern except to see that what is contracted for is delivered. Of itself, the Edison Company lays such ducts as are required, erects the poles, equips them with lamps, cleans, trims, and repairs the lamps, and turns current on and off, without any additional obligation on the part of the City. The contract has the great advantage that all dealings of

the City are direct with the Company, there being no middleman, and more important still, no middleman's profit.

On the other hand, in the gas lighting, the City not only buys light of the Rising Sun Company, but it also is obliged to pay a rate for the use of lamps, and is required to furnish the posts upon which the latter are installed. Another disadvantage is that the gas used is purchased by the Rising Sun Company from the Boston Consolidated Gas Company, and is resold to the City at a profit. This undesirable arrangement has in the main been responsible for the extensions of the Rising Sun contracts, year after year, since any new company coming into the field has always been brought face to face with the problem of making an immediate investment of about $150,000 for the installation of equipment, and this in spite of the fact that the Rising Sun Company has frequently been underbid on five-year contracts.

The Boston Edison Company now offers to cover at once the whole lighting of the city, extending its conduits, wires and pole lines as needed, and to install sixty-candlepower tungsten lamps and supply the entire service, including maintenance, at a price of $22.31 per lamp per year. This proposition would save the City $1.29 per lamp per year on the present rate of $23.60 per lamp, or a total saving of $15,480 on the installation of 12,000 lamps, and this would be effected without any expenditure on the part of the City.

The Boston Consolidated Gas Company offers to sell gas directly to the City, at a cost of $235,000, if the latter will purchase the required equipment in the way of mantle lamps. Under this proposal the City would do its own lighting. Another proposal is for the City to buy the lights at a cost of $20.31 per lamp per year, the Gas Company supplying the gas and maintenance. The former proposal is objectionable on the ground that it requires the City to concern itself with the purchase and maintenance of the gas-lighting equipment, and while the offer of the Gas Company of $19.58 per lamp per year enables a considerable saving to appear on paper, the City itself has scarcely shown the ability economically to administer such work as the installation and maintenance of such a plant, and the outcome of any contract which places the burden of maintenance upon the municipality is regarded as most doubtful. The second offer of the Gas Company to repair, light and care for the lamps is still open to the objection that it calls upon the City to make an investment for equipment when what it wishes to buy is simply light.

In the face of these efforts of the Gas Company to secure the business the clear-cut proposition of the Boston Edison Company deserves acceptance by the city authorities. Already numerous naphtha and gas lamps have been displaced by tungsten incandescents in the outlying areas, and the city authorities have pronounced against the practicability of automatic electric gas lighting. On account of labor conditions, it is doubtful if automatic gas equipment could be successfully used at present in Boston, even if it were in better condition from the technical point of view. A few faint objections have been raised upon the ground that it would be hazardous to place all the street lighting in the hands of a single company, but in view of the progressive work done in Boston under central-station auspices and the incomparably superior illumination given by electricity over gas, even with the latest types of mantles, and also in view of the opportunity to appeal to the Massachusetts Gas and Electric Light Commission in regard to prices, there is no reasonable ground for refraining to adopt the Edison service. The maintenance of candlepower during the life of the tungsten lamp excels anything which can as yet be done by gas. Well-informed opinion in Boston recognizes the necessity of breaking away from the costly restrictions of gas lighting, freeing the City from responsibility for any feature of the service, and substituting instantaneous control of illumination of the highest quality for the archaic equipment and methods of performing the present gas service.

Decorative Lighting Proposed in Niagara Falls.

A definite proposition for the projected decorative lighting of Falls Street in Niagara Falls, N. Y., has been laid before the joint committee of the Board of Trade and the Common Council. Plans for the illumination have been submitted by W. D'Arcy Ryan, the well-known illuminating engineer of the General Electric Company. These plans call for posts of a decorative design along the street about seventy-five feet apart, with arches extending across the street. The posts are to be of bronze finish and the arches are to be illuminated with a dozen tungsten lamps varying from sixty to 100 candlepower each. The posts will each have a pair of 100-candlepower lamps. All lamps are to be in frosted globes. It is planned to carry the decorative scheme into effect in Falls Street from the monument to Third Street, and in Third Street from Falls Street to the Schoellkopf Bridge and on Main Street from South Avenue to North Avenue.

English Patent Decision on Tungsten Lamps.

The Solicitor General of England has affirmed a British Patent Office decision to grant a patent to the Consortium fuer Elektrochemische Industrie Ges., of Nuremburg, Germany, covering the purification and consolidation of tungsten filaments previous to their use by heating them, electrically or otherwise, to a temperature close to the melting point of tungsten (2,800 degrees centigrade). The British patent (No. 15,021) was applied for on July 6, 1906, and the final decision is dated August 5, 1910. The application for the German patent was filed July 5, 1905. Severe opposition to the granting of the British patent was made by Dr. A. Just, Dr. F. Hanaman and the Deutsche Gasglühlicht Auergesellschaft.

Another "White Way" Established.

A "White Way" has been established by the brilliant lighting of five blocks of Chestnut Stret, in Virginia, Minn. There are ten ornamental lamp-posts in each block and each post carries a group of five tungsten lamps. The central lamp on each post burns all night, and the four bracket lamps till midnight only. The system was put in by the Park Board at a total cost of about $6,000. Current is supplied and the equipment is to be maintained in first-class condition by the Virginia Electric Power and Water Company at a cost to the city of about $250 per month.

Magnetite Arcs in Chester, Pa.

The Beacon Light Company, of Chester, Pa., has substituted magnetite arc lamps for the old open arcs formerly used for street lighting. The change has met with great favor on the part of all concerned.

TELEGRAPHY—TELEPHONY, and WIRELESS.

TELEPHONE TRAIN DISPATCHING.—I.

A NEW DEVELOPMENT IN THE ART.

BY K. W. ENDRES.

The telephone being one of the oldest members of the electrical family, the engineer in his big brotherly sort of way rather looks upon it as having settled down to a respectable middle-aged life. He expects nothing startling in the way of developments in telephony—when he actually reaches the expectant stage—rather a steady growth in its use and minor improvements in apparatus. It appears, however, that there is still some young blood in this versatile apparatus and it is branching out into new and hitherto unconquered fields.

Telephone train dispatching is the latest commercial development. It is of very recent growth, practically all within the past two years, but even in that brief period its strides forward have been tremendous and the growth of its popularity equally strong. The telephone has come into the railroad field, which has always been the exclusive province of the telegraph, because it can perform the same service more economically, more quickly and better, in addition to numerous advantages it possesses peculiar to itself.

There is no branch of railroading more carefully and conscientiously maintained at a uniformly high level than the dispatching force. On these men and their apparatus hang the lives of the many million of travelers over the whole of this wide country. They are men who must not make mistakes, because an error here does not mean merely a financial loss, it is paid for only too frequently by human lives and human suffering. It is small wonder then that a railroad's first requirement for anything connected with the dispatchers is safety—*absolute safety*. The telephone has passed this requirement most successfully, as is evidenced by its adoption over nearly 30,000 miles of railroad in the United States, and its prospective adoption in the immediate future over almost as much more. Furthermore, the telephone's record at present stands clean. There has not been a single accident which can be laid at its door.

FIG. 1.—DISPATCHER'S OFFICE, NORFOLK & WESTERN RAILROAD.

The telephone method is faster, not only because the dispatcher can call a station with one motion (and have the bell there ring until he stops it), but also because experience shows that way-station operators answer the bell more quickly than they ever did the telegraph sounder. In addition to this, there is the gain in speed of transmission. A good telegraph operator will send at a speed of perhaps fifty words per minute. In railroad service this figure can be quite safely cut in two, owing to the poor grade of operators which have to be employed. With the telephone a man can talk at the rate of 100 words a minute easily and for everything but train orders themselves this gain is made. Train orders are very carefully sent out, all figures and names of stations being both spoken and spelled as a matter of safety. Further, the dispatcher writes out the order as he gives it, thus regulating his speed to that which permits everyone on the line getting the order down correctly. Each way-station operator then repeats the message back in turn and the dispatcher underlines each word as it comes in. This is the same procedure as is followed in telegraphing orders, with the important exception that the dispatcher writes the order as he sends it. Many a mistake has been made in the service owing to the fact that an operator was unable to read the Morse being sent him quickly enough and thereby omitting or guessing at important words. For this reason the telephone is safer than the telegraph.

The personal equation also comes in and it has been a surprise to everyone concerned in this branch of telephony how important a factor this is. Telegraphing is a strain on both the nerves and muscles of an operator, no matter how mechanical he becomes. The consequent effect on his temper is sometimes quite obvious also. Neither does a man ever get to feel really in close touch with his superior when the only evidence he gets of the presence of the man above is a series of dots and dashes. Now when the men can talk to each other by word of mouth they become better acquainted, a more cordial spirit of co-operation creeps in, the discipline is improved and so is the service.

There is no chance either for the waystation operator to claim his signal did

FIG. 2.—USING PORTABLE TELEPHONE ON ERIE RAILROAD.

not sound, for he has a bell to call him, which, of course, can be heard to a much greater distance than a sounder. The dispatcher, by means of an ingenious arrangement of the bell circuit, can tell in every case whether or not the bell of the called station actually rang. This is called the "answer-back" and takes the form of a distinctive buzz in the dispatcher's head receiver. It can be produced only by the ringing of the bell. It is also perfectly possible and is, as a matter of fact, being done on numerous railroads, to connect listening sets to the line at any point desired. In this way the chief dispatcher or superintendent can supervise the service at any time he may desire, unknown to the operators. All these things tend to raise the grade of service, because it is well known they can be and are done.

The use of a bell for signaling operators has caused a universal improvement in the dispatching service. So many stations have an operator who is agent also that a signal which can be heard over a greater distance than a sounder is appreciated by everyone concerned. With a bell that can be heard easily several hundred feet away, the operator can be performing his duties as agent out in the freight shed or away from the building and still be within sound of the selector bell. In order that the full advantage may be obtained from this feature, the dispatcher can control the length of the ring. In other words, if he does not get an immediate answer he can ring that waystation steadily until he does receive an answer or as long as he may wish.

The feature of telephone train dispatching which is perhaps the most picturesque appeals, however, to the railroad man as well as to the general public. This is the use of portable telephone sets upon such a line. The passengers are interested because it is practically the only visible evidence they ever get that their train is being run under definite orders. The railroad man looks upon this from a different point of view. To him it means minutes in time of emergency and minutes at such times may usually be directly translated into dollars and cents.

Every road which is dispatching by telephone is also employing portable sets. By means of these, the train crew on the wrecker, or on a regular train can get into instant and direct touch with the dispatcher. They can give him details on the spot. They can tell him exactly what the condition of affairs is, thereby enabling the proper assistance to be sent without delay. In the case of a bad wreck, such information coming almost simultaneously with the wreck may save a road thousands of dollars. Actual cases are on record where it has.

Further than this the use of portable telephones on all trains is spreading rapidly. They have been found to be of inestimable service in the everyday running of the road. If an engine blows out a stuffing box, breaks a valve rod or meets with any one of the numerous small road accidents which frequently happen, it is no longer necessary to keep a dispatcher fuming over what may have happened to that train and trying to patch up his schedules. Now he can be told at once on the spot by the conductor of the train and the latter can be given his orders out in the woods or wherever the train may be stalled.

The portable set is connected to the line by means of a jointed fishing pole up which runs a pair of wires. The top section spreads and clamps the line wires between spring clips, giving a firm contact.

The telephone has also had and is having today a serious influence on the labor question. Naturally it gives a railroad a much broader field from which to draw operators. The advantage of not being forced to first consider a man's qualifications as a telegrapher before employing him for a dispatching position has been obvious from the start. No case is known at present of a road having made any change in

FIG. 3.—SIDING TELEPHONE SET.

its operators due to the installation of the telephone system and none would naturally be expected. A knowledge of railroading is, of course, a primary essential.

The new arrival, however, gives the roads an opportunity to retain in their employ many men who have been injured in service, men who would be perfectly suitable for operators were it not for the formerly needed knowledge of telegraphy. It enables the road to place men in these positions who are really railroad men.

Another advantage peculiar to the telephone is the facility it gives for keeping all trains on a division in close touch with the dispatcher by means of what are known as siding sets. The use of portable sets has already been mentioned; siding telephones perform the same functions, only, instead of being carried on trains, they are permanently located at intervals along the right of way. These sets may be placed in stations not of sufficient importance to

warrant a selector; they may be located in blocking cabins or in booths built on the line. In many cases a special design of set is employed which may be mounted directly on the poles. This latter is in an iron weatherproof case which is locked and can be opened by train crews or linemen.

The siding set has proved an invaluable feature of telephone train dispatching. These sets are generally placed at sidings, water-tanks, draw-bridges and other points of importance and the time they save is wonderful. Formerly when a freight was ordered to pass another train at a certain siding it moved to that point and waited. If anything happened to the other train the freight still waited; it had no means of reaching the dispatcher and trains are only too frequently hung up for hours in this way.

But after the telephone system is installed this does not happen. If the freight finds itself waiting too long the conductor merely goes to the siding telephone, calls up the dispatcher and finds out just what he is to do. Oftentimes in this way a freight can be advanced many miles, owing to some unforeseen delay to another train.

It is reported that quite a number of lost cars are being discovered by means of the telephone also. If a conductor sees a stray car on a siding, he asks the dispatcher what he shall do with it on the spot. Previously the chances were excellent that he would forget all about it before he reached someone who could report it.

Thus in many ways the telephone is improving train dispatching; in small ways perhaps, considering each such thing by itself, but in the aggregate in a large, broad, modern way. It is introducing economies, simplifying the work and making for better service every way. Therefore it is spreading.

(To be continued.)

The Boston Telephone Situation.

The Boston Chamber of Commerce, through its directors, has just voted approval of the principle of the new schedule of telephone rates proposed for the Boston district by Professor Dugald C. Jackson, the expert adviser to the Massachusetts Highway Commission, which has in charge a revision of the Boston and suburban rates. This action by the Chamber is of considerable significance as showing the way in which scientific regulation of telephone and other public utility rates is gaining the approval and understanding of business men who have no technical knowledge of the intricacies of these questions. Professor Jackson has already done notable work in this field, as head of the commission which in 1907 made an exhaustive study of the Chicago telephone situation, and laid the foundation for the granting of a new franchise to the Chicago Telephone Company. The workableness of the system for allocating investment, expenses and income to the various classes of service has been abundantly proved by the experience in Chicago, where the results under the new system of accounts has made it possible to tell with accuracy just how much each class of telephone users should pay to the company, and how far the actual rates were well adjusted.

Discussion of the proposed rates for Boston has naturally brought out some opposition, partly from those who mistakenly thought they would have to pay more for their telephone service under the new plan, and partly from those who have benefited by the present system to the extent of getting their service actually much below the cost to the telephone company of giving that service. The committee of the Boston Chamber of Commerce whose report the directors have approved, presents some of the main points in the situation as follows:

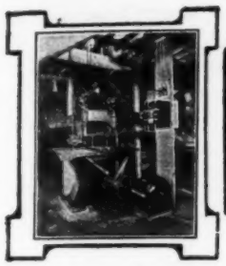
"With respect to the area within which the user of a telephone may have free connection, the number of exchanges with which he may have free connection, and the extent of the service given him without extra charge, the situation in Boston is unique. * * * One of the results of this is that a person who has signed what is known as an 'unlimited Boston and Suburban' telephone contract has the privilege of free connection with any one of 15,000 telephones located within a territory of 436 square miles, including the whole of Boston and 40 of the surrounding towns and cities. No similar situation exists in any city of the same size in this or any other country."

This statement might seem to be favorable to the present system, but that its meaning is not that is shown by the later statement of the committee that the proposed rates are expected to reduce the gross income of the telephone company by about $400,000. The generousness of the service noted above is accounted for by the opinion of the experts that the New England Telephone Company has only been able to furnish this service at the rate charged for it by charging other telephone users more than they reasonably should be charged; "and this has, in turn," says the committee, "had the effect of preventing many people who desire to make a limited use of the telephone from becoming subscribers. * * * Your committee agrees with the experts * * * that there should be a readjustment of the charges made for telephone service, so that the various users will be required to pay for the kind and extent of service that they obtain, and so that the smaller user of the telephone will no longer have to pay more than his just share."

The new system of telephone rates based on the zone or belt principle, which has been ordered to be introduced in Boston on November 1, is arousing some opposition among suburban subscribers whose rates will go up. The East Dedham Business and Improvement Association held a meeting recently and condemned the new telephone rates. It resolved "that the rights of the people demand that the Highway Commission be abolished." The Association further indorsed the action of other cities and towns requesting the governor to intervene to prevent the new rates from going into effect. A meeting of the town and city officials from the suburban district was held at the American House, September 23, to protest against the new rates. The district will be organized and an attempt made to hold up the changes until a petition for further investigation can be sent to the Legislature.

The Panama Telephone System.

In the September issue of *The Telephone News*, of Philadelphia, there is an interesting article on the extensive telephone system installed along the forty-seven miles of the Panama Canal to facilitate its construction. The fourteen illustrations accompanying the article give a good idea of the difficulties met with in building the telephone lines.



Industrial Power

Water Purification by Ozone.

Consul W. D. Hunter, of Nice, France, contributes the following information on the purification of water by ozone, as practiced in France.

As the water used in Nice for drinking and other purposes was considered to be unwholesome, a new method of sterilization has been adopted. There is an electric power plant worked by water turbines, the force being provided by the water which is afterwards sterilized. The two dynamos are run separately, so that there can be no stoppage while one of them is being cleaned or repaired. The electric current is produced at 110 volts, 500 periods per second, and is stepped up to a pressure of 17,000 volts. This high-pressure current is conducted to a so-called ozone battery. Each of the five batteries composing a system consists of three vertical copper plates two feet square and one and one-half inches thick, with a space of eight inches between each; in each of these spaces there is a pair of glass sheets, between which the electric sparks decompose the air, which is forced through them by a suction machine. The decomposed air consists of ozone and nitrogenous compounds, etc. The nitrogenous products are retained and the pure ozone made available by passing the ozonized air through a vertical vitrified pipe containing charcoal dust and pieces of cement. The water, under the pressure of a fall of twelve feet, flows through a system of earthen tubes about one inch in diameter and having thirty-three holes each; these tubes pass through a space filled with ozone, which the water absorbs.

After this first process of sterilization the water flows into a tank in which there is a wire netting supporting about three feet of pebbles; these pebbles divide the water so that it falls like a heavy rain to the bottom of the tank and a strong ozone current, coming from the sides of the tank, is absorbed by the falling water. The ozone is then extracted by having the water fall on stone steps. Medical authorities declare that after having undergone this process water is absolutely germ-free and that it is impossible to produce any kind of germ culture in it.

Two ozone plants were built in 1909; one of them gives an output of 39.61 gallons per second, and the other 79.22 gallons. Each of these plants is composed of two separate systems, so that there can be no possibility of a shortage of water. A new plant is under construction which is to be large enough to supply all the towns and cities between Nice and Mentone, a distance of twenty-four miles. New waterworks are also to be constructed in the near future at both Cannes and Grasse.

Electricity on Shipboard.

An interesting lecture on "Electricity on Shipboard," containing an impartial résumé of the principal applications of electricity in the operation of a modern ship, was recently given by J. M. Heslop before the Engineering Society of the Technical College of Sunderland, England. An extended abstract of this lecture appeared in the July, 1910, issue of *Cassier's Magazine*.

Commenting on the introduction of electric lighting on board ship, Mr. Heslop remarks: "It reduced considerably the risk of fire from lamps and reduced to a minimum the trouble and expense of attendance. Perhaps the strongest proof of these claims is the extensive, in fact almost universal, adoption of electric light on board ship within a very few years of its introduction."

A description is given of the various types of electric lighting equipment in general use, with many practical hints on maintenance. In one of the paragraphs devoted to actual lighting units, Mr. Heslop gives a brief description of the indirect lighting system used in the first-class saloon of the Cunard liner *Mauretania*. This ship is one of the few which has a dome over the saloon, and full advantage is taken of this feature in the lighting system. The lamps are hidden in the dome and are arranged so that they throw their light onto a gilded convex disk in the summit of the dome. The result is that a soft red glow is thrown over the saloon, the effect being that of a "rich red sunset."

The question of searchlights is taken up in some detail, with especial reference to their adaptation for lighting ship canals. The regulations of the Suez Canal are discussed in this connection.

Among other points referred to in the lecture are the applications of the electric motor on shipboard, as for hoists, capstans, winches, electrically operated watertight doors, etc.

In conclusion the lecturer remarks: "If one considers that this has been achieved in a little over thirty years, it seems that in the near future electricity will reign supreme on board ship."

Electricity in Contracting, a Good Example.

A good example of the use of electricity in contracting is given by the London *Electrical Review* in the following description of a contractor's plant on an important undertaking in Scotland:

All the machinery required on the important Loch Arklet contract is driven by electrical power. The contract, which is in the hands of Charles Brand & Company, is for the converting of that loch, and an area of ground round about, into a water reservoir in connection with Loch Katrine for the Glasgow water supply. The power house is on the Loch Lamond side. Pipes convey water from the small river known as the Arklet Water to the power house, where two Pelton wheels, of 135 brake-horsepower each, drive two compound-wound generators of eighty kilowatts

each. The effective hydraulic head is 300 feet. Cables convey the power to the works at the dam and the tunnel, the latter being distant six miles. An aerial ropeway is also worked by electric power, a motor of fifty-five brake-horsepower being installed for this purpose. This aerial ropeway is one and one-half miles in length, and is constructed on the Bleichert system, carrying fifty tons per hour in single loads of two tons each. Rock boring is done by air drills driven by compressed air at a pressure of eighty pounds per square inch, and the compressors, which are situated at the dam and at the tunnel, are operated by forty-horsepower electric motors. There are also two electrically driven gyratory stone crushers; and a large concrete mixer capable of turning out thirty cubic yards of concrete per hour is worked by electricity. All the cranes, varying in lifting power from three to five tons, are electrically driven. The pumps also, and various labor-saving appliances in use over the contract, are worked by electricity.

The first cost of the installation has been somewhat heavy. In order to secure an ample supply of water for the power-house pipes during the dry seasons, the contractors had to build a dam across the outlet from Loch Arklet into the little river; and the distance from the power house on Lomond to the far end of Loch Arklet, where the aqueduct tunnel is being constructed to connect with Loch Katrine, involved considerable outlay in cables. But on the other hand the contractors have an ample supply of power for every description of machinery, and expect at the conclusion of the contract to have benefited financially by having been able to dispense with all steam-driven plant, with the consequent saving in working costs, apart from the time saved by the free use of electrically operated appliances.

Air-Nitrate Fertilizers.

Copies of a lecture on "The Utilization of Atmospheric Nitrogen," by Arthur W. Crossley, delivered at a recent meeting of the Pharmaceutical Society of Great Britain, and a publication entitled "The Manufacture of Calcium Carbide at the Odda Works of the Alby United Carbide Factories, Ltd.," have been placed on file at the Bureau of Manufactures, Washington, D. C., and may be consulted by interested parties.

A New Resistor Furnace.

Experiments have been made in a zinc-smelting works in Upper Silesia, Germany, with a 150-kilowatt furnace in which the charge in the crucible is heated by radiation from an electrical resistor. By building the furnace with double walls, bottom, and cover, and burning fuel in the space thus formed, so as to keep the temperature therein approximately the same as that of the working chamber, it is stated to be possible to almost completely prevent loss of electrically generated heat, and to expect very great economies, especially in large furnaces. Furnaces of this type have been run continuously for nearly two months, and they may be allowed to cool repeatedly without having to be repaired. They are suitable for many other metallurgical operations besides zinc smelting.—*Metallurgical and Chemical Engineering.*

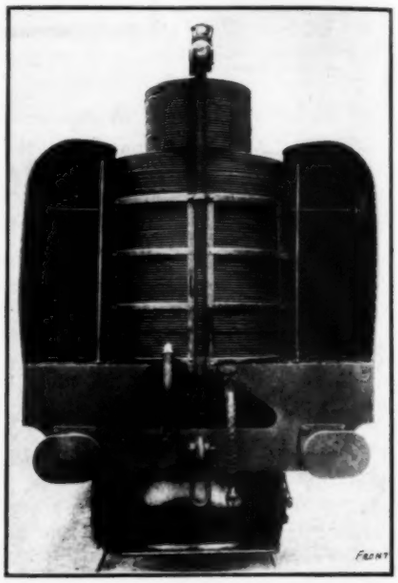
Electric Mining Developments in Montana.

The Butte (Mont.) correspondent of *The Mining World* says in a recent issue of that journal:

The installation of the new hoisting plant on the Anaconda hill is aiming toward one of the important additional saving in costs of production in this district. The plant will be completed in the course of two months and electricity will then be applied for hoisting purposes to three of the principal mines of the Anaconda Company, namely, the Mountain View, High Ore and Diamond, and the electric power for hoisting will be gradually extended thereafter to the other properties. Hoisting will be done by air from an electrically driven air compressor instead of steam. The power is already in, but it is supplied to the mines through the Missouri River Power Company at present. The installation of the new plant has been made at a cost of about $400,000 and when completed and in use will reduce the cost of hoisting to one-third of what it is costing the company now through the employment of steam power. The Great Falls power line is nearly completed to the Washoe smelter in Anaconda and a substation is being built there.

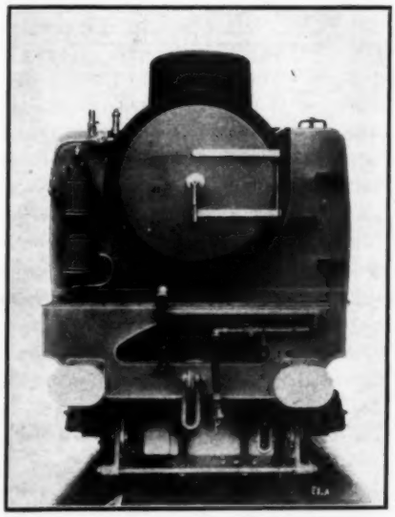
New English Electric Locomotive.

A short time ago reference was made in our London letter to an experiment in Scotland, on the principle of the historic Heilmann locomotive, with a completely self-contained elec-



FRONT END OF TURBO-LOCOMOTIVE.

tric locomotive. This, in short, is an electric generating station on wheels and, of course, has in view the possibility of dispensing with third rails or overhead wires. This unique engine has now been completed and has



REAR END OF TURBO-LOCOMOTIVE.

carried out short trial trips on the main lines of the Caledonian and North British Railway Companies.

Official tests have not yet been concluded, and the makers, as well as the railway companies concerned, are nat-

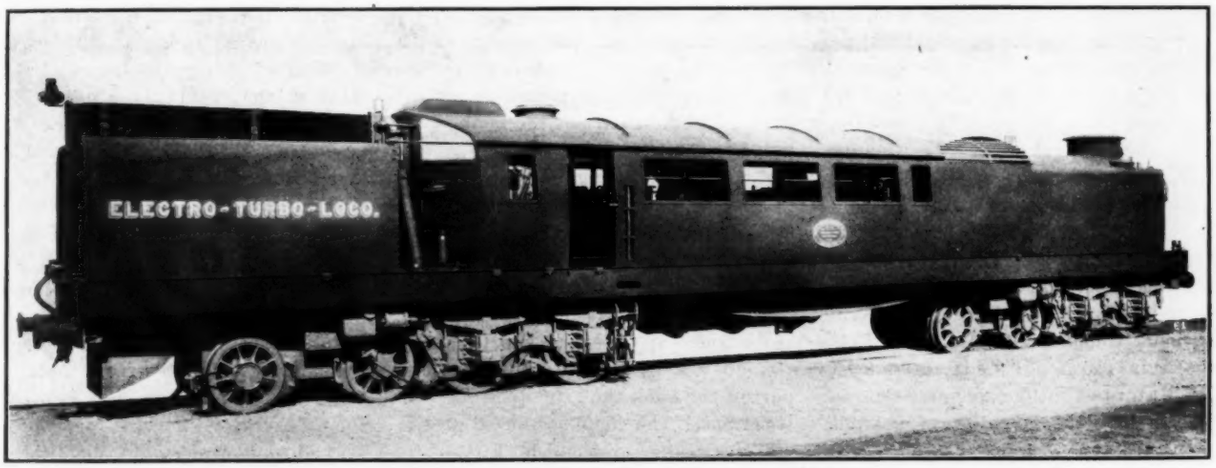
urally somewhat reticent as to publishing descriptive details. The following general description, however, together with the accompanying illustrations, will give a good idea of the new locomotive:

Steam is generated in a boiler of the ordinary locomotive type, which is fitted with a superheater, and the coal and water supplies are carried in bunkers and water tanks at both sides of the boiler. The steam from the boiler is led to a turbine of the Zoelly impulse type running at a speed of 3,000 revolutions per minute. A direct-current variable-voltage dynamo is directly coupled to the turbine. The dynamo supplies current at pressures varying from 200 to 600 volts to four series-wound traction motors, the armatures of which are built on the four driving axles of the locomotive. The exhaust steam from the turbine passes into an ejector condenser and is, together with the circulating condensing water, delivered eventually to the hot-well. As the steam turbine requires no internal lubrication, the water of condensation is free from oil, and consequently is returned from the hot-well direct to the boiler by means of a feed pump. The water evaporated by the boiler is therefore returned to the boiler again and again, and the supply of water carried in the tank is actually circulating water for condensation purposes. This condensing water is circulated within practically a closed cycle by means of small centrifugal pumps driven by auxiliary steam turbines placed alongside the main turbine and dynamo. The cycle of condensing water is from the tanks through the first pump, then through the condenser, where it becomes heated in condensing the exhaust steam, then to the hot-well. From the hot-well it passes through the second pump to the cooler, situated in front of the locomotive, where the full benefit of the blast of air caused by the movement of the locomotive, aided by a fan, is utilized for cooling the hot circulating water. After passing through the cooler, the water is returned to the supply tanks ready for further condensation.

The condensation of the exhaust steam deprives the locomotive boiler of the usual exhaust blast, which induces the draft through the boiler tubes and firebox. In the experimental locomotive the induced draft is replaced by forced draft, provided by means of a small turbine-driven fan. The fan is placed within the cooler, so that it will deliver hot air to the boiler fire, and at the same time assist the current of air through the cooler. The small switchboard and the instruments required, the controller for grouping the four motors in series, series parallel, and parallel, according to the drawbar pull to be exerted, and the regulator for controlling the voltage in the electrical circuit and consequently the speed of the train, are all placed on the driver's platform within easy reach.

The foregoing comprises the main auxiliary machinery of the experimental locomotive. The whole is mounted on a strong underframe, which is carried upon two eight-wheeled compound trucks so constructed that they will easily negotiate curves. Each truck carries two of the four driving motors already referred to. As the engine is intended for express passenger main-line work, it is hoped to obtain comparisons from its actual working with the performances of the reciprocating - steam - engine locomotives, especially as regards the relative consumption of fuel and water, and also as to the efficiency of transforming the energy of steam into drawbar or train pull, as well as the relative rapidity of acceleration under the old and new systems.

The designers point out that most of the component parts of this steam-turbine electric locomotive have already proved themselves effective and efficient in other applications, and the novelty lies in the combination of the different elements of which the locomotive is composed. The expected results in this case should not, therefore, be so problematical as in an invention where the novelty is in the details, and it is the question of the cost of the locomotive which most troubles the patentees or raises any doubt as to its free adoption. The engine was built by the North British Locomotive Company, of Glasgow, Scotland. G



SIDE VIEW OF ELECTRIC TURBO-LOCOMOTIVE.

Chicago Traction Merger Deferred.

Hope of obtaining the passage of the Chicago Consolidated Traction-Chicago Railways ordinance before the council convenes regularly October 3 has been abandoned by the administration. Announcement that no special meeting for this purpose will be called has been made by Mayor Busse.

BOOK REVIEWS.

"The History of the Telephone," by Herbert N. Casson. Chicago: A. C. McClurg & Company. Cloth, 268 pages (5½x8¾ inches), illustrated. Supplied by the Electrical Review Publishing Company for $1.50.

This latest work by the author of "The Romance of Steel," "The Romance of the Reaper," etc., is written in the same interesting and fascinating style as characterized his former books and established for them a permanent place in American libraries. "The History of the Telephone," in every chapter, contains information that should be deeply interesting to the telephone fraternity, and the general public will find it full of entertaining and instructive data respecting the wonderful invention of Alexander Graham Bell that in importance and influence stands at the head of the inventions of the world. The pioneer telephone men, and the work they did are pictured and described, and the invention, development and legal battles of this instrument are graphically and ably told. The book contains nine chapters as follows: Chapter I, The Birth of the Telephone; II, The Building of the Business; III, The Holding of the Business; IV, The Development of the Art; V, The Expansion of the Business; VI, Notable Users of the Telephone; VII, The Telephone and National Efficiency; VIII, The Telephone in Foreign Countries, and IX, The Future of the Telephone. Chapter I deals with the invention of the telephone, describes the difficulties that had to be overcome and contains a biographical sketch of Bell bringing out features of his early life that have never before been published. Chapters II to IV inclusive interestingly describe how the invention was made a commercial possibility, how men now famous realized the wonderful opportunities it offered and devoted all the ability and money at their command to the development and expansion of the business. In these chapters the career of Theodore N. Vail is interwoven in the story and his wonderful work and foresight in appreciating the possibilities of the telephone form an interesting part of the work. The chapter devoted to notable users of the telephone is self-explanatory. It deals with the most prominent men of modern times and describes what an important part the telephone played in their lives. Likewise Chapter VII is devoted to the value of the telephone to the entire country. Conditions at the present time are compared with the days before the telephone was in use and the influential part it has played strikingly pictured. Chapter VIII is a historical review of the telephone situation in foreign countries and contains valuable statistics on this subject. The concluding chapter deals with an optomistic outline of the future possibilities of the telephone.

"Schutz der Hochspannungsanlagen" (Protection of High-tension Installations). By Hermann Zipp. Hanover, Germany: Dr. Max Janecke. Boards, 168 pages (6¾x4½ inches), 109 illustrations. Price, 3 marks.

Considering the large extent to which high-tension transmission has grown and the importance of thorough protection of such installations from all kinds of excess potentials, it is surprising how little has been published in book form on this topic. The author of this handbook has laudably compiled in compact form a mass of such knowledge as we have of the causes of excess potentials and the best means of guarding against them. The first part of the book is devoted to a pithy review of the phenomena occurring during lightning storms in the neighborhood of overhead conductors and during the passage of slowly moving charged clouds across or along a line. The phenomena of internal surges caused by resonance, switching operations, short-circuits, etc., are also considered. In the second part of the book the principles and construction of the commonly used protective devices are described. First there are considered those devices which are intended to prevent the formation of excess potentials and static charges, among them being the grounding of the non-conducting parts of the equipment, provision of ground wires over the line, grounding of neutrals, gradual loading of cables, use of condensers, etc. Lightning-arresters proper are then taken up in some detail, particular attention being directed to the horn type and multigap arresters and relatively little to the electrolytic type. After treating of auxiliary apparatus, such as choke coils, the author concludes with a discussion of where and how protective devices should be installed, calling attention especially to the precautions necessary in the installation work and describing several typical equipments. This book naturally dwells mostly on European practice, where the conditions are largely different from those met with here. For this very reason it should be of value to the broad-minded engineer who wishes to make himself familiar with all possible ways of solving these problems. An English translation would therefore be desirable.

"Elektrische Uhren" (Electric Clocks). By Dr. A. Tobler and Johannes Zacharias. Leipzig, Germany: A. Hartleben. Paper, xv+255 pages (7¼x5¼ inches), 120 illustrations. Price, 3 marks.

This is the second edition of Dr. Tobler's book, which has been completely revised and brought to date by Herr Zacharias. All extraneous material in the earlier edition, such as that relating to fire-alarm telegraphs, has been eliminated and its place taken by the latest developments in the art. As now compiled the book forms an excellent treatise on the various systems of operating electric clocks of all kinds. The electric drive of the clockwork through the pendulum, through lifting of clock weights and through winding of springs is discussed as applied in the best known makes. The electric operation of secondary clocks having merely dials is then considered and followed by electric methods of striking the hours or smaller divisions. Sources of current and methods of making contact direct and through relays are taken up. Considerable space is devoted to master-clocks and the telegraphic control of extensive systems of secondary time-pieces from them, even wireless telegraphy being considered for this service. Several forms of electric chronographs for scientific purposes are described. The book concludes with a list of inventions of various features of electric clocks as disclosed in the German patents granted in this line during the years 1877 to 1909. As a whole the book is of marked value as being the first compilation of the extensive work already done in this highly important field.

Argentina's Electrical Imports.

According to a recent Belgian consular report, Argentina purchases electrical goods from foreign countries in percentages as follows: Germany, 49.1; Great Britain, 31.2; United States, 9.8; France, 3.6; Italy, 3.3; Belgium, 1.4.

Thus Germany gets nearly one-half this export trade, Great Britain nearly one-third, and the United States less than one-tenth. Such figures demonstrate the immense potential foreign trade awaiting American exploitation.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

KANSAS CITY RAILWAY AND LIGHT.

The report of the Kansas City Railway and Light Company for the month of July and two months ended July 31 compares as follows:

	1910.	1909.
July gross	$ 623,492	$ 564,048
Expenses	380,969	329,492
July net	242,523	234,556
Charges and taxes	186,715	172,039
July surplus	55,808	62,517
Two months' gross	1,240,756	1,126,843
Expenses	754,625	652,617
Two months' net	486,131	474,226
Charges and taxes	372,147	343,792
Two months' surplus	113,984	130,434

AURORA, ELGIN & CHICAGO.

The report of the Aurora, Elgin & Chicago Railroad Company for the month of July, compares as follows:

	1910.	1909.
July gross	$182,387	$167,614
Expenses	87,612	77,895
July net	94,775	89,719
Charges and tax	32,569	28,899
Surplus	62,206	60,820

FEDERAL TELEPHONE AND TELEGRAPH.

The Federal Telephone and Telegraph Company (Buffalo) reports earnings for the six months ended June 30, 1910, compared as follows:

	1910	1909
Exchange rentals and tolls	$428,480	$374,702
Expenses and taxes	183,587	178,983
Net earnings	244,892	195,719
Charges	123,915	116,714
Surplus	120,977	79,005

WESTERN UNION EARNINGS.

The Western Union Telegraph Company has issued its preliminary estimated statement of earnings for the quarter ended September 30, 1910. The actual figures for the same period of 1909 compare as follows:

	*1910	1909
Net revenue	$2,000,000	$1,929,275
Bond interest	433,062	433,062
Balance	1,566,938	1,496,213
Dividends	747,770	747,492
Surplus	819,168	748,721
Previous surplus	†22,415,012	17,269,278
Total surplus	23,234,180	18,017,999

*Estimated. †Quarter ended June 30, estimated.

The estimated figures of the Western Union, for the quarter ended September 30, as usual, do not allow for depreciation or reconstruction, beyond current expenditures, and the necessary amount has not yet been determined.

The customary quarterly statement of the actual earnings of the company to June 30 was omitted from the present report, pending the preparation by chartered accountants of the full balance sheet as of June 30, 1910, and of the full annual report to be presented to stockholders at the annual meeting.

FONDA, JOHNSTOWN AND GLOVERSVILLE.

The report of the Fonda, Johnstown and Gloversville Railroad Company for the quarter ended June 30, 1910, compares as follows:

	1910	1909
Total railway operating revenue	$241,658	$211,396
Total railway operating expenses	105,555	92,188
Net railway operating revenue	136,104	119,209
Net revenue from outside operating, debit	5,000	4,702
Total net revenue from operation	131,104	114,506
Taxes accrued	9,491	10,482
Operating income	121,613	104,024
Other income	1,899	4,202
Gross income	123,512	108,226
Total deductions from gross income	87,796	82,963
Net corporate income	35,715	25,263

UTICA AND MOHAWK VALLEY.

The report of the Utica and Mohawk Valley Railway Company for the quarter ended June 30, 1910, compares as follows:

	1910	1909
Total street railroad operating revenue	$311,029	$308,839
Total street railroad operating expenses	183,303	191,314
Net street railroad operating revenue	127,726	117,525
Taxes accrued	16,610	18,088
Operating income	11,116	99,437
Non-operating income	661	597
Gross income	111,777	100,034
Total deductions from gross income	56,798	56,195
Net corporate income	54,980	43,839

WESTERN ELECTRIC COMPANY.

The Western Electric Company has issued a statement of earnings to the New York Stock Exchange covering the year ended December 31, 1909, as follows:

Gross sales	$45,575,138
Cost	43,171,128
Net profit on sales	2,404,010
Interest paid	313,746
Net profits on investment	2,090,264
Dividends paid	1,200,000
Added to surplus	890,264

MINNEAPOLIS GENERAL ELECTRIC COMPANY.

	1910	1909
Gross earnings	$ 88,965	$ 77,543
Net earnings	53,111	40,280
Surplus over charges	23,387	10,717

SIERRA PACIFIC ELECTRIC COMPANY.

	1910	1909
Gross earnings	$ 44,802	$ 42,130
Net earnings	29,449	27,438
Surplus over charges	23,472	21,535

TAMPA ELECTRIC COMPANY.

	1910	1909
Gross earnings	$ 51,507	$ 47,172
Net earnings	22,606	16,769
Surplus over charges	15,895	12,068

Westinghouse Business During August.

While the final figures for the shipments of electrical apparatus from the works of the Westinghouse Electric and Manufacturing Company during the month of August have not been tabulated, semi-official reports show that they will reach an amount close upon $3,500,000. This indicates that the machinery turned out and shipped from the electric company's factories during the year will foot up the enormous sum of $42,000,000,

AMONG THE CONTRACTORS AND SUPPLY MEN

To know what is going on among the men who do things and those who supply the material for the doing is always interesting. The actual happenings of the day with the contractors and the men who furnish them with supplies of all kinds, accurately reported from all parts of the country, is the object of this department.

BOYD & GARRISON, Michigan City, Ind., recently opened an electrical supply house at 309 Franklin Street, of that city.

F. E. NEWCOMER & COMPANY, Atlanta, Ga., were awarded the contract for furnishing electrical supplies for the penitentiary at Atlanta.

THE SACKETT MINE SUPPLY COMPANY, Columbus, O., received the contract for electrical work in the new Knights of Columbus Building.

WILLIAM H. POPE, Plainfield, N. J., secured the contract for installing a complete electric light system in the greenhouses of J. B. Duke's estate at Raritan.

THE NATIONAL ELECTRICAL SUPPLY COMPANY, Washington, D. C., has been awarded the contract for wiring the Franklin school of Washington. The contract price was $903.

GROVER & HELEKER COMPANY, Syracuse, N. Y., has incorporated and will do a general electrical business. The stock is held by Harry F. Grover, Emily P. Heleker and Clarence Heleker.

CLARENCE KENNEDY, Tyler, Tex., has opened up an electrical supply store, and will deal in all kinds of electrical supplies and fixtures. Mr. Kennedy will also do an electrical contracting business.

THE C. & G. COOPER COMPANY, Mt. Vernon, O., has been awarded the contract for the power equipment in the Vanderbilt Hotel, now under construction on Upper Broadway. The order calls for two 200-kilowatt, and one 100-kilowatt unit direct-connected to Corliss engines. The contract price is reported to be about $35,000.

THE GRAY SIGN COMPANY, Knoxville, Tenn., has recently erected a number of large, striking, electric signs. Twelve signs are now in the process of construction and will be ready for the opening of the Appalachian exposition, October 12. The Gray Sign Company has made rapid strides in the way of securing new business in the past few years.

New Electrical and Mechanical Apparatus and Appliances.

SWITCHBOARD MATERIALS.

BY C. F. ADAMS.

The early history of electric lighting records little of interest to the student of switchboards. Then, electric instruments were generally mounted on some variety of hard wood, and the term "switchboard" was a correct descriptive title.

Arc-light machines were of ten and sixteen-lamp capacity and the pioneer incandescent lamps were operated at from fifty to seventy volts. A thirty-kilowatt dynamo was a large machine for those days.

The insulation question and the operating temperatures of instruments and conductors was a matter of small concern. Instruments, switches, fuses and lightning arresters were all mounted on wood bases. Wood was found to be unstable, even when carefully varnished, warping from heat or moisture, and, also, from some "unknown cause," the wood mountings were occasionally subject to fire.

The use of small slabs of slate for the mounting of fuses and plug switches was the first application of fireproof material to instrument mounting. A larger slab, mounting several instruments, was a natural development, these slabs being mounted on a skeleton wooden frame.

As lighting and power systems grew, and the importance of continuous service was recognized, the question of fire risks was carefully studied. Wood was abandoned and the fireproof switchboard was a reality. The decorative element in polished marble or enameled slate was fully realized, and the careful matching of shade and grain was an art in itself.

For handling high potentials and heavy currents the oil switch was evolved, and the era of the oil switch wrought disaster for the ornamental marble or slate structures. The back and edges of slabs were varnished or otherwise treated to resist the invasion of oil. A heavy "short," expelling oil in a flaming shower has damaged many a handsome slab. The crowded oil switch mounted in tiers on the back of a "fireproof" board has almost disappeared. These essential devices are now relegated to the concrete or asbestos wood cell for obvious reasons.

For purposes of insulation, the limits of quarried materials were soon reached. A hygroscopic material is affected by the atmosphere, and the marble slab was often boiled in paraffin to render it more stable as an insulator. Fine metallic veins were ever present and these would lead to current creepage an ultimate disaster.

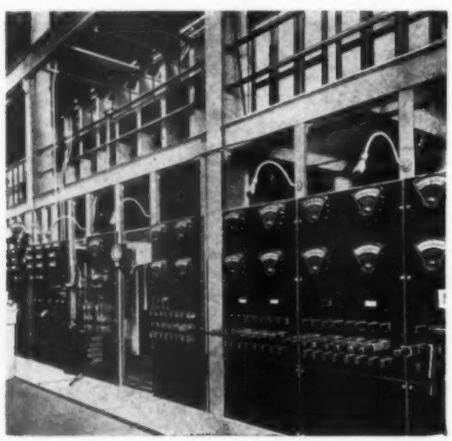
The advance of the art called for a better material. A material of high permanent insulating quality, and at the same time fireproof, as regards combustion and capable of sustaining high heat without disintegration. A material mechanically strong and free from the breakage and defacing incident to stone. A material easily machined and permanent of form and structure. A material impervious to moisture or oil, and a surface capable of a pleasing finish. These are the desired qualities of the ideal switchboard material.

These requirements seem to have been met in a product known as J-M ebony asbestos wood, composed of asbestos fiber, and other insulating and waterproofing materials, which is being extensively used in switchboard work.

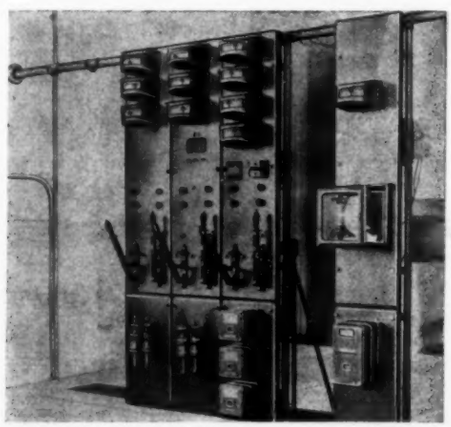
Two years' observation of J-M ebony asbestos wood in service shows no deterioration, either electrically or mechanically according to the manufacturer, the H. W. Johns-Manville Company. It is employed for switchboard panels, high-tension switch tops, air switch or fuse bases, for barriers, and other uses. The external finish given this material in service is generally a dead black varnish.

In a test of some two-inch J-M ebony asbestos wood switch tops for 60,000-volt switches, metal plates two inches by four inches were placed on the surface six inches apart and the voltage raised to 40,000 volts before there was any apparent surface leakage, nor would this voltage puncture these tops which were two inches thick, although marble would have failed at about 10,000 to 12,000 volts.

The illustrations show two station installations to which it has been applied on the Pacific Coast.



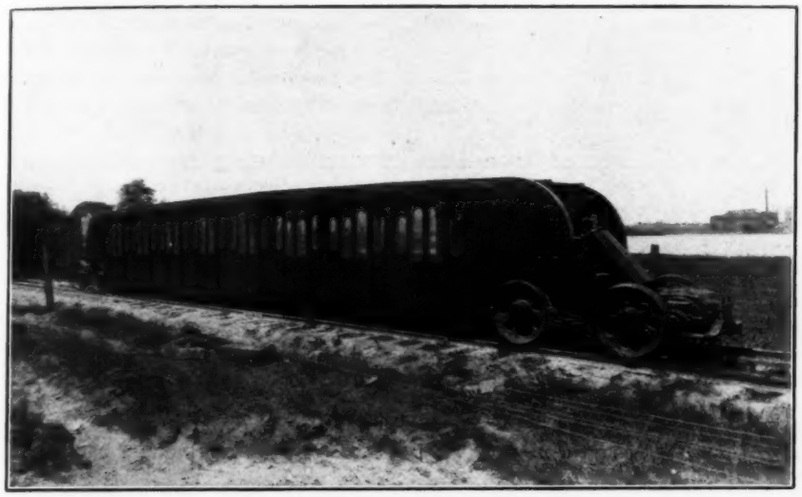
SWITCHBOARD CONSTRUCTED OF EBONY ASBESTOS WOOD.



ANOTHER INSTALLATION OF EBONY ASBESTOS WOOD.

The Du Pont Subway Car.

A new type of car that it seems will cause decided modifications in future subways, has recently been developed by the Cleveland Under-Ground Railway Company, 1101 American Trust Building, Cleveland, O.



VIEW OF THE DU PONT SUBWAY CAR.

The car is the invention of A. B. Du Pont. Its essential fetures are its low center of gravity and small cross-sectional area. One car has been built and is now being used for demonstration purposes on an experimental track at East 105th Street and Quincy Avenue, Cleveland. This track is 2,400 feet long and includes a curve of 49 feet radius and a dip of 6 feet in 150 feet. At one end a frame building, representing a subway, has been built over 200 feet of the track; the entrance to the building allows but 1 inch clearance all around the car, yet so steadily does it run, owing to its low center of gravity, that the car has never touched the entrance, although it has been run through it a hundred times at a speed of twenty-five miles an hour. The steadiness is very apparent while the car is taking the dip or rounding the curve.

INTERIOR VIEW OF CAR.

The small cross-sectional area of the car allows a material reduction in the size of the subway. At the experimental track the subway measures 7 feet 6 inches from top of rail to roof and 13 feet side to side, this gives room for two tracks. As the area is but forty per cent of the area of the New York subway, and the cost of construction is approximately proportional to its cross-section, it follows that this will effect a saving in the cost of construction, and the ventilation problem will also be that much less expensive, according to the promoters. Besides the saving in mere cross-sectional work, the depth is so comparatively shallow that it would enable the contractor to avoid the greatest obstacle the subway builder encounters, namely, the sewers. Moving sewers was no small part of constructing our present subways.

The appearance of the car is shown on the two illustrations. It is built of steel throughout, with the exception, of course, of cushions on the seats, three by three by three-eighths angles and three-sixteenths-inch plate composing most of the structure. The weight is carried chiefly by four three by five by one-half angles, two at the top and two at the bottom of the sides of the car. The car has a camber of four inches which will probably be reduced in subsequent cars as the full load produces no material deflection. The bottom of the car is but 6 inches above the top of rail. Over all dimensions it measures 58 feet; center to center of trucks, 48 feet; inside to inside, 5 feet 6 inches; floor to ceiling 6 feet 6 inches

It will be noticed in the illustration that in order to reduce the width it was necessary to put the wheels outside the bearings, reversing the usual railway practice. The track is standard four feet eight and one-half inches gauge. It being impossible to put the ordinary brake rigging with its levers on a car that has no room available underneath, the problem was solved by putting a comparatively large brake cylinder between the brake beams, attaching the cylinder to one beam and the piston to the other, a half inch movement thus gives all the braking power required. Direct air at sixty-five pounds is used for its operation.

A trolley wire is in the middle of the track, the trolley being held in position by a spring so that it is impossible for it to leave the wire. It is intended to operate the cars in trains with multiple controllers, the drawhead being shown in the illustration about the center of the controller. The car has a seventy-five-horsepower motor.

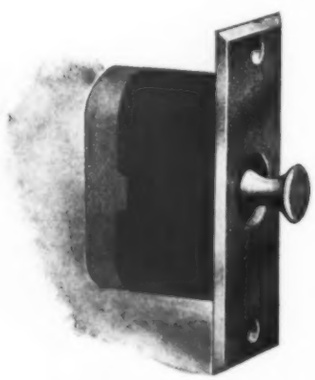
New Battery Switch.

A small and ingenious battery switch has recently been put on the market by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. While designed specially for use on automobiles yet its high rating of ten amperes, eighty volts, makes it suitable for use on any low-voltage circuit where a compact inclosed switch is desired.

The operating mechanism is the same as is used on other Cutler-Hammer push-button switches, consisting of only three moving parts, the push-bar, coil spring and contact piece. The device is therefore simple, rugged and self-indicating. The rounded ends of the switch fit the hole made by an ordinary bit, so that it is not necessary to chisel out the corners as with a square-ended switch. When desired it can also be mounted as a surface switch by providing a mat, the depth of the switch being only one and three-sixteenths inches.

When employed for gang mounting, spacing strips are furnished which insure proper alinement and facilitate installation. The contacts on the rear are heavy and so arranged that a common return wire can be run straight across any number of switches, which it is said is a decided advantage in this type of switch.

Flush plates are made in four stand-



NEW CUTLER-HAMMER BATTERY SWITCH.

ard finishes—brush brass, polished brass, polished nickel and gun metal. and for one, two, three and four switches. As the plates are furnished separate from the switch, it is possible to arrange combinations of switches without carrying so large a stock as is necessary when the plates are an integral part of the battery switch.

Recent Radical Improvements in the Mazda Lamp.

The member companies of the National Electric Lamp Association have begun to supply, in limited quantities, a new form of the Mazda lamp, wrought out in the laboratories of the Association, and representing, it is be-

NEW FORM OF MAZDA LAMP.

lieved, one of the most important advances yet made in the development of the incandescent lamp.

The principal points which distinguish the newcomer from its predecessors have to do with the methods of making and mounting the filament, which is produced in the form of a long ductile wire, by means of processes which the Association claims is unlike any of those hitherto employed in the manufacture of tungsten filaments. Mazda lamps made from this wire have continuous filaments, as distinguished from lamps having non continuous filaments.

The connection between the wire filament and the leading-in wires is made by means of a "clamped joint" similar to that used in tantalum lamps. Such a joint is more or less flexible, and it is therefore evident that all rigid points of filament attachment have been eliminated.

Mazda lamps made from the newly developed wire will stand without damage a blow from two to four times as severe as will an ordinary tungsten-filament lamp. The wire as manufactured at present is ductile and flexible, but becomes less ductile after the lamp is first lighted. The increased strength is mainly due to the improved methods of support, as explained above. The new Mazda is practically equal to the present Mazda as regards life and candlepower performance.

Mazda wire lamps can, at present, be obtained in only a very limited number of types, since the facilities for the manufacture of the wire are limited. Manufacturing details are being worked out as rapidly as circumstances will allow, however, and it is probable that, in time, lamps made with the newly developed wire will be regularly supplied in all types.

The following manufacturers are selling the new lamps: The Banner Electric Company, the Brilliant Electric Company, Bryan-Marsh Company, the Buckeye Electric Company, the Colonial Electric Company, the Columbia Incandescent Lamp Company, the Fostoria Incandescent Lamp Company, the General Incandescent Lamp Company, the Monarch Incandescent Lamp Company, New York & Ohio Company, the Shelby Electric Company, the Standard Electrical Manufacturing Company, the Sterling Electrical Manufacturing Company, the Sunbeam Incandescent Lamp Company and the Warren Electric & Specialty Company.

Tungsten Rosettes.

The Trumbull Electric Manufacturing Company, Plainville, Conn., has just put on the market a new rosette, designed for use with tungsten lamps.

As is shown in the cut, the laminated cotton felt cushion takes the support off the lamp and eliminates all vibration from the tungsten-lamp filament. This allows these tungsten lamps to be used in factories and lofts, where vibration is encountered.

The life of a tungsten lamp will be greatly prolonged when suitable shock

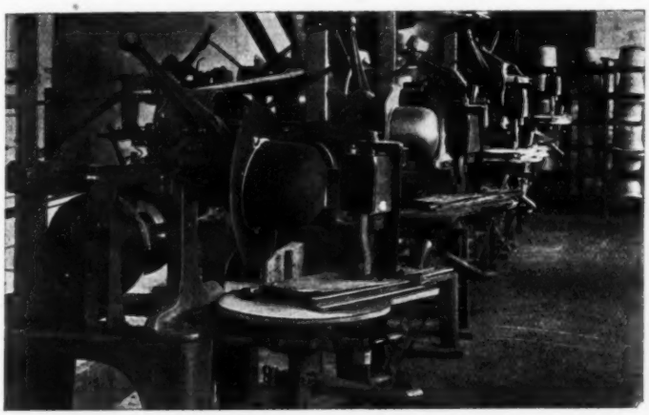
SECTIONAL VIEW OF TRUMBULL TUNGSTEN ROSETTE.

absorbers are used, especially in installations where lamps are subjected to more or less severe vibration. In spite of the fact that mechanically the construction of tungsten lamps has been considerably improved, their filaments are still fragile, and these rosettes are strongly recommended for use in all places where the lamps are subject to vibration.

Electric Heat in the Manufacture of Hats.

In the manufacture of hats, power is required to drive the machinery; artificial light is needed for a portion of the year; heat is required for sizing, coloring and drying, and heated tools are necessary for the finishing processes. Electric motors furnish the most flexible means of delivering the power to the machines. Electric light is best for illuminating the work room, and electric heat, for the finishing processes, presents unequaled advantages as to cleanliness, convenience, and reliability.

An electric heater can be arranged to provide any temperature obtainable with gas-heated apparatus. It is not affected by air drafts and does not fill the workroom with soot. This cleanliness is of particular importance in the manufacture of straw or light-colored felt hats.



INTERIOR OF AN ELECTRICALLY OPERATED HAT FACTORY AT NEWARK, N. J.

By its use, the fire risk is eliminated, as there are no exposed flames. The worker is not exposed to the hot, ill-smelling waste gases, which rise from tools heated by gas-blast, and the problem of ventilating the hat factory is greatly simplified.

The favorable results, obtained through the adoption of electric heaters, are made evident, to those concerns which use them, by a very material increase in the output of the factory and by a reduction in manufacturing cost, while the cost of the heat required per unit of the article manufactured, is decreased. The productive capacity of both skilled and unskilled labor is increased and the conditions of the operatives greatly improved wherever flameless heat is adopted.

The Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., is placing on the market a full line of electric appliances for use in the manufacture of hats which makes it possible for the hat manufacturer to obtain the favorable results mentioned above.

For the manufacture of felt hats the following electrical apparatus may be obtained: Hand shells, machine irons, velouring stoves, shackle stoves, hand shackles, ovens, tip press heads for printing and embossing bands and tips, curling machines, flanging bags, and brim heaters.

The following electrical apparatus is available for use in the manufacture of straw hats: Hand flats, hand-flat stands, heat controllers for hand flats, machine flats, pressing machines and glue pots and cookers.

The accompanying illustration is a view in a hat factory, in Newark, equipped throughout with Westinghouse appliances.

Air-Cooled Electric Drills.

Owing to the ease with which current may be secured in shops or in the vicinity of trolley or third-rail lines the electric drill has found a considerable use there especially for the heavier work. Drills have been perfected which give good service on lines of from 500 to 650 volts and are proving to be of considerable value for this class of work. The drills are comparatively light, easily handled and with one of them work can be done in about one-tenth of the time required by the old hand method.

The drills in use at present are constructed so that they can meet the requirements of the heaviest kind of work. As the larger drills are built with three revolving armatures a compact machine results and the feed screw may then be placed in the center of the drill. The armatures are small and can be run at a high rate of speed, which gives a much better circulation of air and thus dissipates the heat very rapidly. Ventilating fans are provided so that the circulation is further materially aided.

A feature has been introduced with these electric drills so that they can be supported by magnets. The electromagnetic supports may be applied to the I-beam or material to be drilled and the drill operator may be seated upon this. One of these supports, supplied from a 550 volt circuit has carried a weight of 210 pounds.

Heavy air-cooled drills are made for direct as well as for alternating current. These are wound for 110 and 220 volts and may be utilized to special advantage in drilling, tapping, reaming and tube expanding.

Electrically Cooked Meal for Commonwealth Edison Sales Force.

At a recent meeting of the Commonwealth Edison Sales Committee, held in the basement of the Electric Shop, at Jackson and Michigan Boulevards, Chicago, there was provided an innovation in the form of an electrically cooked meal which served to demonstrate the possibilities of the electric range in the household.

Every portion of the meal, consisting of soup, meat, vegetables, salad, dessert and coffee, was prepared on an electric range, the time required being about two hours. It is stated that the current consumed for preparing this meal was 2,074 watt-hours and as there were eighteen present the cost of current per person would be 1.15 cents, figuring the cost of current on a basis of ten cents per kilowatt-hour.

The economy of the electric range lies in the fact that intense heat is stored in the burners and oven and the process of cooking continues for a long period after the current has been turned off.

The table on the occasion mentioned above was tastily decorated, miniature electric lamps being interwoven in the floral decorations. Electric cigar lighters were also employed following the dinner, making the event an "electrical" one from every point of view.

The electric range employed was supplied by the Hughes Electric Heating Company, Chicago, Ill., and was of the type designed for families not exceeding eight in number.

The Operation of a New Telephone Selector.

The telephone selector, in its use on train dispatching circuits, is an ingenious mechanism for calling singly the several stations along a line. Selectors are being made with a view to obtaining high speed in operation. With a new selector, one recently developed by engineers of the Western Electric Company, it requires approximately three seconds to call the thirtieth station on the line, and any one of the first ten stations will be called in one second or less. Selectors now being installed are equipped to care for fifty stations, which will cover the majority of train dispatching circuits.

The simplicity of this selector lies in the fact that there is scarcely anything to get out of order. The moving parts consist of a ratchet wheel, to which is fastened a contact, and a hardened steel spring pawl, by means of which this wheel is stepped around. This pawl and a corresponding one on the under side of the ratchet wheel are connected directly to the armatures of the magnet, and, therefore, as long as the magnet operates the pawl must move.

The selector is normally operated on the central-energy principle, but can be arranged for local-battery service if it is so desired.

The operation of the Western Electric selector is as follows: In front of the train dispatcher are a number of keys, one for each equipped station on the line. These keys are practically noiseless, and each one sends out a number of rapid direct-current impulses on the line when it is operated. The number of impulses which are sent out can be regulated by adjustable cams on the rear of the key so that a standard key is employed in all cases and adjusted for the particular station desired. This is an improvement in train dispatching service.

The first impulse which one of these keys sends out is a long impulse, the tooth being three or four times the width of the ordinary tooth. This impulse operates the magnet shown on the right-hand of the selector, which is a slow-acting relay; it pulls up the armature of this magnet, which in turn causes the two pawls to engage with the ratchet wheel. The remaining quick impulses which the key sends out operate the magnet on the opposite side of the selector but do not affect the slow-acting magnet, which remains held up; these quick impulses work the pawl which appears at the top of the selector and step the ratchet wheel around the proper number of teeth, at which point the two contacts are made and the bell in the station is rung.

The remainder of the revolution of the key, after the signaling impulses are complete, keeps the key contact closed and, therefore, keeps battery on the line during a period of about five seconds. As long as this battery is on the line, the bell at the way-station rings.

LAYING CONDUIT IN OAKLAND, CAL.

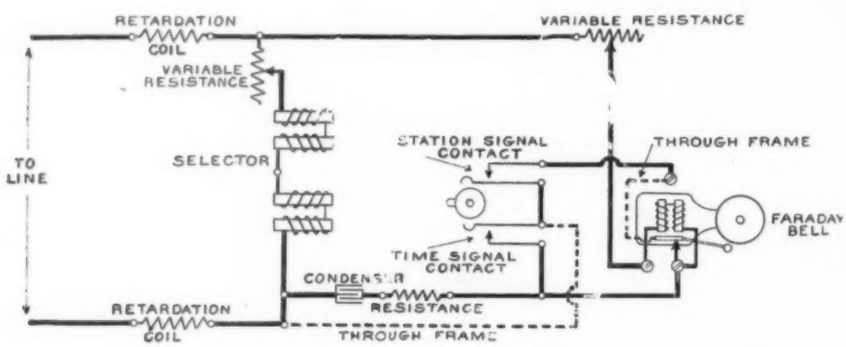
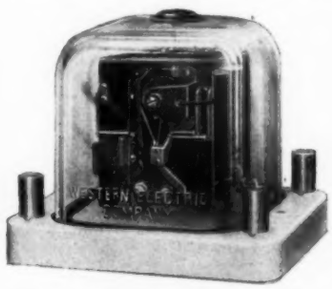


DIAGRAM OF SELECTOR CIRCUIT.

Laying Conduit in Water-soaked Soil.

A recent installation of conduit in water-soaked soil in the West, presented a number of interesting conditions that are worthy of note. The Pacific Gas and Electric Company faced the problem, in Oakland, of laying conduit in soil that was constantly filled with tide water.

The company solved its problem by excavating the trench, then digging a deep hole into which the water from the trench ran. All materials being ready, a reinforced concrete vault, properly waterproofed, was constructed the whole length of the excavated trench. The conduit was laid into this concreted trench and the whole line sealed with a concrete covering as usual. Though the initial expense of the procedure may seem large, the line is removed from any depreciation expense and, according to the manufacturer of the conduit, should last a century without maintenance cost. The conduit used in this installation was supplied by the Clay Product Company, Chicago, Ill., which attributes the increase in its conduit business, during the present year, to the fact that it has entirely abandoned the manufacture of all other clay products and is putting the whole force of its organization to improve this one special commodity.



WESTERN ELECTRIC SELECTOR.

General Electric Buildings Started.

The National Fire Proofing Company has already started men and material to the site of the new buildings for the General Electric Company at Erie, Pa. The structure will be completed by January 1, 1911. The General Electric Company will spend $13,000,000 on equipment.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, SEPTEMBER 10.—The announcement is officially made in London of the amalgamation of the Berlin Allgemeine Elektricitäts Gesellschaft, with the Felten and Guileaume Lahmeyerwerke Aktien-gesellschaft. The works of the latter company are to be made over to the former.

The gas industry came in for some severe handling at the British Association meeting which has just concluded at Sheffield. Prof. Armstrong, the chemist, who resides in London, said that much as he disliked electricity, he was being forced to use it owing to the effect upon his furniture and pictures of the impurities in the gas now being supplied.

The question of gas versus electricity for street lighting is attracting a considerable amount of attention at present, especially in London. The Westminster contracts will, no doubt, be remembered, but despite the victory of the Gas Company in Westminster, one stubborn fact is that out of 1,055 street electric lamps only sixty-six are being replaced by gas, and this purely on the question of price, the terms offered by the Gas Company being admittedly below cost. This the electrical companies refused to do. Moreover, Westminster is about the only place in the country where the Council is in the happy position of being able to reap the benefit of cut-throat competition between two trading concerns dealing in gas and electricity. In Westminster, electricity has practically always held the field. Several London borough councils are adapting metal-filament lamps exclusively for street lighting and are able to do the work at less cost, giving higher candlepower, than the Gas Company.

Much interest is still being given to the proposal of the municipalities throughout the kingdom to promote a bill authorizing them to carry out the wiring and fitting of consumers' premises for electric light. In spite of the feeling with which this matter is discussed at various conferences, it is surprising that there is not more unanimity of purpose when it comes to a pledge being given to furnish financial support. About forty authorities are giving the proposal whole-hearted support. On this point it is pleasing to note that the Leicester Corporation, against which an injunction was recently granted, has accepted the position and is now working loyally with the contractors in that town.

A rubber exhibition is to be held in London next year, when a special section will be set aside to electrical goods made wholely or partly of rubber. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, SEPTEMBER 9.—The Oerlikon Company has been making tests with the new electric locomotives which are to be used on the Lötschberg standard-gauge railroad in Switzerland. Some of the trials had already been carried out on the Seebach-Wettingen electric line before the electrical equipment was taken down. As regards the Lötschberg railroad, the section lying on the north side of the tunnel and running from Spiez to Frutigen is already completed. The company intends to use the first electric locomotives upon this section in order to show their performance.

In the Jura region of France a local power company is engaged in increasing its network of lines and hydraulic plants, and it will soon begin to construct two power plants at the locality of Cize-Bolozon which will have 2,000 horsepower each. The current generated will be added to the supply which the company's plants at Sault are now producing, and the lines are worked on the three-phase system at 35,000 volts. The work includes the erection of a power line running from Cize-Bolozon to Villefranche and Macon with a branch line to Bourg. These two latter towns lie on the Paris-Lyons-Mediterranean railroad.

The municipality of Amsterdam is taking measures to increase the tramway plant of the city and is purchasing new material for this purpose. I also note the new electric plant which is to be erected in Holland for the supply of the towns of Deventer and Zwolle.

There is to be built a new line of tramway at Brussels very shortly, and the project is already under way.

Producer gas is to be the motive power in the new electric plant which will be erected at Carthagena, Spain. A syndicate has been formed for promoting the project, and the current will be used for public and private lighting and for motors.

The French navy department is to install a new electric plant at the Toulon docks in the near future. The Minister is considering two projects which have been submitted for this plant. It is to have four 1,600-kilowatt units on the three-phase system at 5,000 volts, and is to begin working at the end of next year.

Following the recent success obtained in America with wireless outfits upon aeroplanes, the French war department will likely take the matter up. The department is now engaged in organizing a concourse for a specially designed aeroplane for army scouting use, and it is proposed to add a condition that such an aeroplane must carry a wireless outfit which will work to ten miles distance.

A steam turbine station of considerable size is to be erected in the vicinity of Nantes, France, and it will be laid out upon the same lines as the St. Denis turbine plant near Paris. This move has been made by a large syndicate in which Paris capitalists are largely interested, and the object of the new plant is to furnish current for the lighting of Nantes and its suburbs, for the supply of power to various industries in this region and also for operating the electric tramways. These latter are to be much improved and extended. The station will be constructed on the banks of the Loire and it will receive its coal supply by barges.

In the region of Budapest there is to be built a standard-gauge electric railway which will serve as an extension of the suburban line now running from Budapest to Nagytetery. From this latter point the new electric line will run as far as the commune of Erd. I note also the new electric road which is to be run from the station of Golling, lying on the Austrian state railroad, to the railroad station of Steeg, which lies upon another branch of railroad. Another electric road will start from Tatrafüred and will run to the town of Csorbato. It will form a branch line from the electric railroad at Tatrafüred. A. DEC.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., SEPTEMBER 17.—The Toronto Railway Company has notified the City of Toronto that it will, in accordance with orders of the Ontario Railway Board, go on with the construction of 100 new cars and fifteen miles of double track to accommodate the increased traffic.

The chairman of the Ontario Hydro-Electrical Commission states that it was hoped after the government system was in good working condition, that the municipalities taking electric power would be obliged only to pay for the amount of power used, and not for the entire amount contracted for.

It is stated that the Georgian Bay canal project is likely to be a prominent feature at the forthcoming session of Dominion parliament. Pressure is being brought to bear upon the government to do the work as a state undertaking. The principal argument advanced in this connection is that the development of water power, resulting from the canal construction, will be such that, even if sold at $5.00 per horsepower, it would produce a revenue sufficient to pay interest on the cost.

The Provincial Power Company is also seeking a contract with the City of Montreal to light the streets of the city. The Company has been operating a power plant for the past two years and has ample power at its disposal. The Company owns and operates the plant at Soulanges which generates power from the Cedar Rapids. It develops 15,000 horsepower at present and it can increase this development to 20,000 whenever necessary.

The decision of the City Council of Toronto to enter into negotiations with the Toronto Street Railway Company for the purchase of its property and plant, has revived public interest in the street-railway problem of that city, and there is much speculation as to what will be the outcome of the latest effort to free the city from an intolerable position. It is estimated that $16,000,000 would be the minimum price that the Company would ask for its holdings. The general discontent with the present management of the road, the overcrowding of cars and the failure of the Company to extend its lines into the newly acquired suburbs is responsible for the present scheme of expropriation.

The first real move to fight the Canadian Light and Power Company for the control of the Montreal Street Railway has been made. Following the announcement that a pact had been entered into between the directors of the Street Railway and The Montreal Light, Heat and Power Company directors to fight the rival power company there was a rush for the stock of the Montreal Power Company, and the same rose suddenly ten points to the record price of 145. It is claimed that an amalgamation of the Montreal and the Street Railway companies, such as was projected by the Canadian Power people, can be effected. Those who are behind this latest proposal, claim that they can offer the shareholders of the railway a much better proposition than can the Canadian Power promoters. They also deny that the rival concern has obtained control of the street-railway stock. W.

COMMISSION NEWS FROM NEW YORK.

(Special Correspondence.)

Max E. Schmidt, president of the Continuous Transit Securities Company, had a conference with Chairman Willcox, of the Public Service Commission, First District, regarding the plans of the company for a moving platform subway. One plan under consideration is for a line under Broadway from Tenth Street to Forty-second Street, thus connecting the Interborough Subway with the proposed Broadway-Lexington Subway. Among those interested in this scheme are Robert Walker, president of the Rock Island Railroad; E. P. Ripley, president of the Atchison Railroad; Cornelius Vanderbilt; F. A. Delano, president of the Wabash, and Stuyvesant Fish.

The Public Service Commission, Second District, has authorized the Red Hook Light and Power Company, of Red Hook, Dutchess County, to take over franchises from John H. Sharpe in the towns of Germantown, Livingston and Clermont, Columbia County, and also to exercise the rights and privileges under these franchises. The Company is also authorized to execute a first mortgage upon all its property, assets and franchises to secure the payment of $150,000 in bonds, payable in fifty years, bearing interest at five per cent. The Company is authorized at the present time to issue $10,000 of its bonds at not less than par in exchange for $10,000 first-mortgage, five-per-cent bonds now outstanding on the property of the corporation; also $60,000 of bonds to be sold at not less than eighty to pay for indebtedness incurred in the construction of new lines and equipment.

The Commission has approved the application of the Municipal Gas Company, of Albany, N. Y., for permission to extend its poles and construction for furnishing of electric light upon and along the Albany and Greene turnpike and intersecting roads in the town of Bethlehem from the line of the city of Albany south to the line of the town of Coeymans. The Company has received twenty-five applications from persons in that territory who want this service and stated in its petition that the applicants had agreed to pay a minimum rate of $2 per month for electric current.

The Commission has also authorized the Southern New York Power Company to issue $24,000 of its capital stock at par in payment of all the property, assets and franchises of the former Walton Electric Light Company, of Walton, N. Y., and $2,100 in payment of all the property, assets and franchises of the Mulkins Electric Light Plant, also situated at Walton. The Company in its application asked for permission to issue $40,000 common capital stock, par value $100 a share, to purchase franchises and property of Walton Electric Light Company.

The Public Service Commission, Second District, has made an order requiring the United Traction Company, of Albany, N. Y., to show cause before the Commission at the capitol, Albany, Tuesday, September 20, at 2 p. m., why the Company should not purchase thirty large double-truck passenger cars for use upon its Pine Hills and West Albany lines, said cars to be purchased and put in use by January 1, 1911. This order follows the complaint made by the Common Council of the city of Albany and exhaustive investigation made by the Commissioners and their electric-railroad expert.

COMMISSION NEWS FROM WISCONSIN.

(Special Correspondence.)

Upon application of the Sheboygan Light, Power and Railway Company the Commission has revoked the certificate of authority to issue $114,000 of bonds, granted January 24, 1910, and has now issued a certificate allowing the same company to issue $205,000 of stock. The issue is to consist of 205 shares of common stock of the par value $100 each. The stock is to be issued in exchange for an equal amount of outstanding indebtedness against the Company, such indebtedness having been incurred by reason of the Company having expended its revenue for extensions and additions to its property.

The North Milwaukee Light and Power Company has been authorized to issue stock as follows: 500 shares of common stock at $500 each to pay outstanding indebtedness incurred by reason of additions to property made and for extensions in the future.

At the request of the municipality of Jefferson the Commission has devised a schedule of rates for electric service to replace those now in force. The old rates were unsatisfactory to consumer and municipality alike.

The investigation showed that while a reduction in rates might be offered, the rates should be readjusted so as to distribute more equitably the burden of expense; that the charge for street lighting should be increased in order that this branch of the service may have its just share of the total cost of operation.

From an analysis of the operating expenses, the apportionment (excluding the consumption expenses) into capacity and output for both the commercial and the municipal lighting is as follows:

	CAPACITY	OUTPUT	TOTAL
Commercial Lighting	$3,320.36	$2,745.75	$6,066.11
Street Lighting	664.23	1,406.64	2,070.87
	$3,984.59	$4,152.39	$8,136.98
Consumption	492.85		492.85
	$4,477.44		$8,629.83

The Commission has recommended a primary rate of sixteen cents per kilowatt-hour for the first sixty hours' use per month of the active connected load and a secondary rate of ten cents per kilowatt hour for all current used in excess of the above amount. From an analysis of the consumer data the following classifications have been devised:

In Class A, consisting of residences, rooming houses, public building, forty per cent of the total connected load is to be considered active.

In Class B, consisting of schools, churches and industrial establishments which close not later than 6 p. m., sixty per cent is to be considered active.

In Class C, consisting of stores, offices, livery stables, banks, saloons, etc., seventy-five per cent is to be considered active.

The Commission also recommends that the present practice of meter rentals be abolished and a uniform minimum bill of fifty cents substituted.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

PLAN NEW DAM FOR THE COLORADO.—The Hydraulic Properties Company of New York is considering the proposition of taking over the contract made by J. C. Dumont, of Austin, Tex., for the erection of a dam across the Colorado River there. M. R. Lyndon, an electrical engineer, has made an examination of the proposed site and other conditions and will make a favorable report to the Company. C. Frank Doebler, secretary of the Company, has also made an investigation of the proposition. If the Hydraulic Properties Company takes over the contract, it is probable that several changes will be made in the plans of the dam. The structure which the Company builds has fewer gates than the one planned by J. C. Dumont, and has the power house at one end instead of in the center of the dam. The proposed dam, which will replace the one destroyed ten years ago, will cost $1,000,000, will be sixty-five feet high and will generate 5,000 horsepower. D.

POWER PROJECT AND A NEW TOWN.—A town known as Metaline Falls, Wash., is being built in the Pend d'Oreille country, 125 miles north of Spokane, by wealthy Spokane men. The town will have as its chief industries a cement mill, costing $1,000,000, now under construction, and a 10,000-horsepower electric plant, nearing completion. The town is at the junction of the Pend d'Oreille River and Sullivan Creek, where in addition to an abundancee of water power, timber, mineral and other undeveloped resources, there is a mountain of limestone and clay, from which the Inland Portland Cement Company and the Metaline Brick Company will manufacture commercial products. Mr. Larson estimates that the water-power plant and rights will cost $375,000. The water is brought down through a tunnel for a distance of 1,600 feet and has a head of 470 feet. The tunnel, driven through a cliff, is lined with concrete the entire distance. In addition to the cement and brick plants there will also be a sawmill.

LIGHTING AND POWER.

(Special Correspondence.)

STEPHENS, ARK.—E. R. Smith, of Trinity, Tex., will establish an electric light plant here. P.

WOODWARD, OKLA.—This city has voted bonds for the construction of an electric light plant. P.

ELBERON, GA.—This place is planning a system of ornamental street lighting for the main thoroughfare.

LEWISBURG, PA.—The Kelly Township Electric Company has been incorporated with a capital of $5,000.

ST. LOUIS, MO.—The Southern Electric Company has been incorporated with a capital stock of $6,000. P.

MONTICELLO, IOWA.—The Monticello Electric Light Company is about to begin the erection of a lighting plant. P.

HAZEN, ARK.—The Hazen Power and Light Company has been organized and will construct a power plant at once. P.

ROCHESTER, MINN.—The Utility Board has petitioned the council for $5,000 for improvements in the electric light plant. C.

SPUR, TEX.—For the first time this town is lighted by electricity. The lighting plant was put in by S. M. Swenson & Son.

MARTINS FERRY, O.—It is expected that the electric light plant will be equipped for operation by November 1, at the latest.

ST. PAUL, MINN.—The Electric Light Company has been granted a franchise in West St. Paul and will begin extending its lines at once. P.

GRAND RAPIDS, MICH.—The Allis-Chalmers Company has been awarded the contract for the equipment at the new lighting station for $28,220.

MADRAS, ORE.—The Newport Engineering Company of Portland has applied for a franchise to install and maintain an electric lighting plant here. A.

LIBERTYVILLE, ILL.—The North Shore Electric Company is installing the tungsten street-lighting system through the residence portion of the city.

SAN FRANCISCO, CAL.—The San Francisco Gas and Electric

Company is planning to build a reinforced-concrete battery house at the cost of $10,000. A.

FERGUS FALLS, MINN.—An effort is being made to induct the Otter Tail Power Company to install an auxiliary steam plant to furnish electric current. C.

BAINBRIDGE ISLAND, WASH.—The Bainbridge Development Company has been granted a franchise to distribute electric power for heat and light throughout this island. A.

SAN FRANCISCO, CAL.—The Downtown Association will install 140 electroliers at the cost of $16,000, in the downtown district. Work will commence next month. A.

WHEELING, W. VA.—The Consumers' Electrical Company has engaged engineers to plan its electrical plant. The completed plant will cost between $700,000 and $900,000.

FARIBAULT, MINN.—The Consumers Power Company will arrange to supply the city with electric light and power from a plant being constructed at Cannon Falls, Minn. C.

PRINCEVILLE, ILL.—By unanimous vote the municipal electric light plant was recently sold to E. L. Brown, of the Elmwood Electric Light Company. The price was $3,000.

SAN BERNARDINO, CAL.—Claiming that the electric light service of this city is costing too much, the Santa Barbara Merchants' Protective Association is urging a municipal plant. A.

DECATUR, ILL.—The contract for installing a new condenser at the city light plant has been let to the Henry Worthington Company of St. Louis, for $4,307. Z.

HOPE, KANS.—Although the contract has not yet been signed this place will probably be supplied with electric power from Herrington. Bonds will probably be voted to secure this improvement.

NORTHBORO, MASS.—The Woodside Woolen Mills are now being operated by electricity supplied by the Marlboro Electric Light Company. The motor installation is giving great satisfaction.

COQUILLE, ORE.—The Coquille Electric Company is installing a new electric power plant to take the place of the machinery recently burned. The plant will be ready for use early in October.

TACOMA, WASH.—It is announced that the contract for the construction of the municipal electric substation to be erected in this city will be awarded to Blows & Tuel on their bid of $103,874. A.

CADIZ, KY.—Alexander Bros., of this place, bought the electric light franchise which was recently ordered sold by the city council, and it is probable that they will begin the erection of a plant within the near future.

PORTLAND, ORE.—The Pacific Power and Light Company is preparing to spend between $500,000 and $600,000 on the construction of 200 miles of electrical transmission lines in Eastern Oregon and Washington. A.

NASHVILLE, TENN.—The East Tennessee Electric Light and Power Company has been incorporated with a capital of $100,000 by J. W. Adams, George B. Adams, H. Crumbliss, Jr., J. K. Hodges and John S. Beck.

UPLAND, CAL.—The Pacific Light and Power Company is putting in a power line from Sixteenth Street directly north to Wineville, a distance of eleven miles. A power house is to be erected in the vicinity of Cucamonga.

LYONS, N. Y.—The Wayne County Gas and Electric Company has asked for a perpetual franchise to erect poles and stretch wires through this place. At present some of the Company's lines are operating without franchises.

LOS ANGELES, CAL.—The City Council has passed an ordinance providing for the issuance of $3,500,000 of electric-plant bonds for continuing work on the aqueduct system from a point in Owen River Valley to San Fernando Valley. A.

QUINCY, ILL.—At a recent meeting of the Civic Improvement League it was decided that ornamental street lights should be installed here. An ornamental-street-lighting committee was elected, with Charles Rosenheim as chairman.

SPOKANE, WASH.—H. H. Shallenburger, of the International Lead and Iron Company, announces that he and his associates will install a 65,000-horsepower hydroelectric plant on the Salmon River. A.

COOKEVILLE, TENN.—An electric light plant has been installed at Baxter, this county, and practically all of the business houses and residences in the town have been wired. There are now four towns in this county which have electric lights.

BONNY EAGLE, ME.—A hydroelectric plant is to be built here by the Consolidated Light Company of Maine. The plant, which is to be built on the same plan as the one at West Buxton, will have a generating capacity of from 4,000 to 6,000 horsepower.

GREENVILLE, TEX.—The new electric light plant of this city, which was built and equipped at a cost of about $100,000, was started up recently. The current was turned into the street arc-light system and was later turned on in the business section of the city.

SANTA BARBARA, CAL.—J. M. Williamson has been awarded the contract for building an addition to the power house of the Santa Barbara Gas & Electric Company. The building is to be 50 by 100 feet, one-story with brick walls and galvanized-iron roof and will cost $7,709. A.

LEAD, S. D.—The Homestake Mining Company let the contract to the Westinghouse Electric and Manufacturing Company, of Pittsburg, Pa., for the equipment of its new power house in Spearfish Canyon. More than 4,500 horsepower will be developed and the plant will cost over $1,000,000. C.

TRINITY CENTER, CAL.—Work has been begun on a new power plant for the Bonanza King mine to replace the one destroyed by fire nearly two years ago. The new plant is smaller than the old. It is planned to have the power plant completed so that mining can be resumed before winter.

DUNKIRK, N. Y.—The board of water commissioners has opened bids for new boilers to be placed in the municipal water and electric light stations. The bids were referred to committee of whole to examine and report. The board is figuring on building a large addition to the power station.

NORTHFIELD, MASS.—At a special town meeting it was voted to install a street-lighting system at a yearly expense of not over $1,200. The committee appointed finds the proposition offered by the Greenfield Electric Light and Power Company to be the most feasible and it is probable that it will be accepted.

NEWINGTON, CONN.—The Housatonic Power Company is to extend its service in Newington from the new Children's Home through Cedar Street to Ridge Road, thence northerly to the Tuberculosis Hospital, where 475 lights have been installed. The company is also extending its service in Stanley Quarter.

CHARLOTTE, N. C.—Work is now progressing rapidly on a new power line from Concord to the Bala cotton mill, which is situated on Coddle Creek about four miles from Concord. The line extends from the substation of the Southern Power Company here to the Bala mill. The line is well under way and will be completed soon.

NEW CASTLE, IND.—Plans for the new power house to be erected by the Terre Haute, Indianapolis & Eastern Traction Company have been approved and work will commence soon. The power house building will cost $280,000, according to the permit, and the Bedford Stone and Construction Company has the general contract.

GALVA, ILL.—The Commercial Club of this city, at a recent meeting, adopted resolutions advocating the sale of the city electric lighting plant to a private company. The purpose underlying this movement for the sale of the plant is to obtain commercial service with all-day power. The municipal plant has been operated for street lighting only.

MARLIN, TEX.—A deal has been closed whereby I. J. Nathan, owner of the electric light and ice plant here, also becomes owner of the electric light plant at Rosebud, having purchased same from a stock company for which M. M. Kemp has been manager. Mr. Nathan will improve the plant and add an ice factory, operating both in conjunction.

LOS ANGELES, CAL.—The Midway Light and Power Company has been incorporated by H. L. Dearing of this city, E. F. Hughes of Sierra Madre, Herbert Williams of Pomona, N. J., Goudge of Alhambra and C. L. Chandler of South Pasadena, with a capital stock of $250,000. Plants will be located in Maricopa and Moran, Cal., and the head office will be in Los Angeles. A.

SHARPSBURG, MD.—This city has accepted the proposition of the Antietam Electric Power Company to install electric lights here. A number of business places and private residences also will be supplied with current for lighting by the Company. Work on the construction of the line from the Company's plant, near Breathed's to this place, has been commenced.

NEENAH, WIS.—Work on the construction of the big power house and the transporting apparatus at Gardner dam, above Shawano on the Wolf River, will start within a short time. The power to be generated there will be under the control of John I. Beggs of Milwaukee. The franchise held by Mr. Beggs specifies that construction work shall be under way within a year.

ALTOONA, PA.—Arrangements have been completed between the Altoona Chamber of Commerce and the Penn Central Light and Power Company for the lighting of Eleventh Avenue between Eleventh and Bridge Streets by the boulevard system. According to the contract that has been made the pedestals will be placed seventy-five feet apart and each will carry five lamps.

OWOSSO, MICH.—A resolution is to be introduced here providing that the city establish an electric lighting plant in connection with the water works. The plant will cost about $30,000, and it is estimated that it will save the city from $3,000 to $5,000 a year. The city is now a patron of the Commonwealth Power Company, whose rates, in the view of many people, are too high.

SODUS, N. Y.—Announcement has been made by the Sodus Gas and Electric Light Company that a decision had been reached by the board of directors to extend the lines of the company to Pultenyville from Williamson, a distance of about four miles. A large flouring mill has agreed to discard steam for electricity, and the village of Pultenyville has asked for street lights.

PORT TOWNSEND, WASH.—The Olympic Power and Development Company has been incorporated by Thomas T. Aldwell, of this city, with a capital stock of $1,000,000. The first plant of the company is to be built on the Elwah River, sitxy miles from here, at a cost of $500,000, approximately. Work on this plant has already been started. A.

COMFORT, TEX.—Steves & Stahmank have just finished a 200-foot well on which they will place an eight-horsepower gasoline engine and electric generator for twenty-five fans on their place of business on Seventh and High Streets. Besides that they will put up a steel tower thirty feet high with a 10,000-gallon water tank with pumping outfit and pipes all over the place.

GENEVA, N. Y.—The Common Council has entered into a contract with the Geneva-Seneca Electric Company for the lighting of the city for a term of five years. Arc lights are to be furnished for $70, and forty-candlepower incandescent lamps at $18 a year. In addition to the contract, the Geneva-Seneca Company was granted a franchise to do a lighting business in Geneva for fifty years.

ORTONVILLE, MINN.—The Minnesota River Improvement and Power Company, of which John R. Diers, of Blakeley, Minn., is secretary, has plans for the construction of three power plants, on the upper Minnesota River, to generate 25,000 horsepower. The construction work will amount to $1,000,000 and the cost of the installation of the electrical apparatus, generators and wires to another million dollars. C.

WASHINGTON, D. C.—The Catholic University of America is about to erect a new power house and engineers' school in Michigan Avenue, near Brookland Avenue, Brookland. It will be constructed of brick, stone and steel, with reinforced concrete, at an estimated cost of $50,000. T. H. Poole, architect, prepared the plans, and the Boyle-Robertson Construction Company will do the construction work.

SAN DIEGO, CAL.—The La Paz Water and Power Company has been incorporated for the purpose of acquiring the stock and properties of the Compania de Luz y Fuerza de La Paz, a Mexican concern. The total capitalization of the concern, as set forth in the articles of incorporation, is to be $500,000, divided into 5,000 shares of $100 each. The life of the corporation is stated as fifty years in the articles.

OREGON, ILL.—The new machinery at the power plant here is now in operation and current will soon be turned on the Franklin Grove, Amboy and Crompton lines. The Polo line will be ready in a few weeks and the company can then dispense with the steam plant there. About $150,000 has been spent in improvements this year and plans have been made involving the expenditure of an equal amount for next year.

MOUNT PLEASANT, N. Y.—Articles of incorporation have been filed by the Philips-Manor Electric Light Company to supply electricity, light, heat and power and do business in the village of North Tarrytown and the town of Mount Pleasant. The capital stock of the company is $50,000 and the directors are Edwin P. Benjamin, Tarrytown; David Elder, Staten Island, and Holmes V. M. Dennis, Jr., New Brunswick, N. J. T.

KANSAS CITY, KANS.—An election will be held to decide on voting bonds for the construction of an electric light plant, if the Supreme Court decides that the city has not already too great an indebtedness. If the supreme court rules that the present water works are an asset an election to vote bonds for the construction of an electric light plant can be called immediately. The service, wires, poles, etc., of the present light company can be bought and a plant erected at a cost of $350,000.

SALT LAKE CITY, UTAH.—The Utah Hotel Company's power plant is now being constructed at an estimated cost of $165,000 on a site near the Tabernacle. It will furnish power, light and heat to the Tabernacle, Assembly Hall, Temple, L. D. S. University buildings, Bishops Building, Hotel Utah, Deseret Gymnasium, Deseret News Building, Vermont Building, and contemplated extensions would include the Lion House and other buildings. The Trent Engineering and Machinery Company of this city has the contract for the undertaking.

THOMAS, W. VA.—The Davis Coal and Coke Company is erecting a central power plant to generate electrical power for all mines located in this district. Twelve mines are to be benefited by this installation. Contracts have already been placed for all members needed in connection with this station and actual construction work is now under way. All work will be completed by February 1, 1911. The electrical plant is to consist of three Curtis turbo-generators, with a capacity of 2,500 kilowatts. Power will be transmitted at 6,600 volts.

FALL RIVER, MASS.—Charlton Mills have awarded contracts for finishing and installing the power plant, partly to the Providence Engineering Works and partly to the Westinghouse Electric and Manufacturing Company. The Providence works will install a Rice and Sargent cross-compound steam engine of 10,000 horsepower, to be used in operating most of the main mill. The Westinghouse Company will install a low pressure turbine of 850-horsepower to be used in developing electrical power for operating the weaving mill, elevators and for some of the spinning.

ELECTRIC RAILWAYS.

(Special Correspondence.)

TACOMA, WASH.—The Northern Pacific Railway Company has been granted a franchise to maintain poles and string wires for the transmission of electric power in Railroad Avenue.

JANESVILLE, WIS.—The sheriff's sale of the Janesville Street Railway has been postponed until Monday, September 26. It is probable the Rockford & Interurban stockholders will be the purchasers. Z.

SAN PEDRO, CAL.—H. E. Huntington will this year construct an electric line connecting this town with Redonda Beach. The line will be built along the cliffs overshadowing Point Vicente and Point Fermin.

LOS ANGELES, CAL.—An ordinance has been passed granting Robt. Marsh and John Howse permission to abandon a portion of their street railway franchise commencing at Vermont Avenue and Thirty-ninth Street.

POMONA, CAL.—H. C. Dunn, of Los Angeles, has been granted the contract for laying steel rails for the Pacific Electric Railroad between Claremont and Upland, Cal. The work is to start soon. A.

SPRINGFIELD, ILL.—The formal opening of the Illinois Traction System's new bridge across the Mississippi River at St. Louis will take place about November 10. Cars will be running across about October 1 but the formal exercises will be postponed. Z.

QUINCY, ILL.—The Quincy Railway Company of Qunicy has been incorporated at Springfield with a capital stock of $50,000 to own and operate a street railway. The incorporators are W. B. McKinley, H. E. Chubbuck and W. J. Achelpehl. This is the company, a part of the McKinley interests which already operates the system here. Z.

LOGAN, UTAH.—The County Commissioners of this county have granted to Leo Neilsen and his associates a franchise for an interurban electric railway from Wellsville through Hyrum along the east edge of the valley, through Hillville and Providence to this city, and from Logan through Greenville and Hyde Park to the Idaho state line. A.

PASADENA, CAL.—The stockholders of the Pasadena Rapid Transit Company will hold a meeting in October for the purpose of creating a bonded indebtedness of $3,000,000 which is to be used in securing the balance of the right of way between here and Los Angeles and to purchase power house and depot sites for the proposed electric line. President Horace Dobbins states that the construction work will commence this winter.

BRYAN, TEXAS.—The Bryan-College Interurban Company, which operates an electric line between Bryan and College, is planning to extend its road into the Brazos River bottoms, connecting with several small towns and traversing a very rich farming district. The company is now preparing to extend its line over the streets of Bryan and to run a loop line around the outskirts of the city. O. E. Gammill is manager of the Company. D.

SPRINGFIELD, ILL.—The first of the new electric engines recently constructed and placed in service by the Illinois Traction System, was given a trial run between Lincoln and Mackinaw with six cars of gravel, and attained and held the speed for the entire distance of the limited cars of the system. These engines will not only be used in freight service, but will be used for the pulling of passenger trains on special occasions when etxra cars are needed to handle large crowds. Z.

GREENVILLE, TEX.—Greenville is now sure of having a modern electric street-car system, to be built and maintained by S. A. Price and associates of Dayton, Ohio. The franchise is for fifty years. It is expected that work will be commenced on the building of the street car line at an early date. The capitalists say it will take between $200,000 and $250,000 to build the system. The officers will be Albert Emanuel, president; L. A. Clark, vice-president, and W. F. Briedenbach, secretary-treasurer.

GETTYSBURG, PA.—The Washington, Frederick and Gettysburg Railway Company has commenced to erect power houses and electrify that line at a cost approximating $300,000. The road, which is now a steam one, runs from Frederick to Thurmont. It is planned to continue the line to this city via Emmetsburg. It is already possible to go from Winchester and Berryville through Martinsburg and Hagerstown to Waynesboro, and Pen Mar. The building of the new link would make it possible to reach Frederick, from which a line is already in operation to Washington.

READING, PA.—Boyertown trolley cars from Reading may soon run through to Pottstown, and there is a possibility that an express service will be inaugurated between Reading and Philadelphia over the Oley Valley, Boyertown and Pottstown and Schuylkill Valley lines to Wissahickon Station, Philadelphia. Negotiations are said to be pending so that the Oley Valley cars can cross the Colebrookdale Railroad in Boyertown, which so far is the only break in the continuous route. This express and through car service is to be modeled after the one now in operation on the Liberty Bell route from Philadelphia to the slate regions.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

MISSOULA, MONT.—The Montana Independent Telephone Company is arranging to complete its circuit to Mullan, Idaho. C.

CHOTEAU, MONT.—The Automatic Telephone Company will overhaul its exchange and make other improvements in its system.

ABERDEEN, WASH.—The Pacific States Telephone and Telegraph Company has laid plans for the expenditure of $90,000 in improvements next year. C.

GONZALES, TEX.—The Gonzales Telephone Company is preparing to move its local headquarters. A new switchboard carrying 1,000 drops will be installed.

WHEELING, W. VA.—The Bell Telephone Company has secured the right of way to reach Shadyside and will soon install a line to that place. A telephone exchange will be installed.

SAN FRANCISCO, CAL.—The Alaska Steamship Company has contracted with the United Wireless Telegraph Company for the equipment of the steamer La Touche with a one-kilowatt plant. A.

NEW YORK, N. Y.—The Olean Interstate Telephone Company has been incorporated with a capital of $50,000 by E. M. Earley, Geo. A. Larkin, both of Olean, N. Y., and E. L. Campbell, Little Valley, N. Y.

ST. PAUL, IND.—The St. Paul Telephone Company has been incorporated with a capital stock of $2,400 to maintain a telephone exchange and lines. The incorporators are: Louis Opfer, Henry Moeller, Jacob Yund, Henry Pfer, Jr., and William Wiseman. Z.

SPRINGFIELD, O.—The Central Union Bell Telephone Company is now receiving material for extensive repairs and additions to its outside plant. The capacity of the switchboard will also be increased. The plant has been practically rebuilt twice during the past eighteen years.

FRANKLIN, TEX.—The Franklin Telephone Company is making extensive improvements in its local telephone service. Old poles are being taken down and large new ones erected in their places. A new and more commodious switchboard is to be put in and the service improved generally.

FLAT ROCK, W. VA.—A charter has been issued to the Flat Rock Independent Telephone Company, which is capitalized at $5,000. The incorporators are: O. D. Dent, of Flat Rock; J. E. Carson, of Greer; G. W. Board, T. J. Coleman, of Letart; H. A. Gerlach, C. W. White and S. A. Smith of Leon.

GREENSBURG, IND.—An arrangement has been perfected whereby the local Independent Telephone Company will take over all the local phones of the Bell Telephone Company, while the latter will handle all the long distance messages. A new automatic switchboard will be installed at a cost of $16,000, but this will reduce operating expenses, as only five operators will be required where now twenty-three are employed.

ALTOONA, PA.—A force of men is now at work placing additional cables and extending the conduit system of the Bell Telephone Company in the city. A city ordinance makes it obligatory on the part of public service corporations using wires to have all their plant within the fire limits under ground before May, 1912. The company now has 5,800 phones in service in this vicinity, including those in use by the Railroad Company.

BLOOMFIELD, IND.—The Linton Mutual Telephone Company has filed articles of incorporation. The object of the company is to establish and operate an independent telephone system in the counties of Green, Clay, Sullivan, Vigo, Knox, Monroe, Owen and Clay, the principal office being at Linton. The directors for the first year are David P. Scott, Thomas E. Harris, Warren Tinstman and George F. Chapman. The capital stock is $10,000.

HUNTSVILLE, ALA.—Twelve thousand dollars will be expended here by the Southern Bell Telephone and Telegraph Company for the improvement of its system in Huntsville. The improvements will consist almost altogether of outdoor work, such as cables and changing the wires to the interior block system. Practically all of the poles will be removed from the business center of the city. Every outside wire that it is practical to remove will be eliminated.

INDIANAPOLIS, IND.—The Central Union Telephone Company has installed an unusual kind of telephone system for the Pennsylvania Railroad round-house station in this city. The telephone system has twenty-eight stations, one in the home of each member of the crew. When there is a call for the crew the operator of the round house can instantly connect all the twenty-eight instruments and by turning a magneto can ring all twenty-eight of the telephones at one time and can give the message to all of them at once. This will prove advantageous in getting a crew out quickly. S.

TUCUMCARI, N. MEX.—J. R. Wasson, president of the Tucumcari Telephone Company, announces that the line which is partially completed from this city to Amarillo, Tex., will be discontinued, since arrangements have been made with the Bell Telephone Company to run a line to this city from Santa Rosa, the present terminal, and through to Dalhart, Tex., thus giving connection with Amarillo and obviating the necessity of building the latter line. The local office will be made a toll office for the Bell Company. The completed portion of the line will be used for rural service.

ELECTRICAL SECURITIES.

During the past week there has been a general feeling that the better conditions which are now prevailing will be permanent. Twice as many stocks were sold as during the previous week, and three times the number of bonds were dealt in. The report of copper stocks abroad was favorable. Exports of this metal increased and prices held firm. The market for steel and iron shows improvement. Inquiries for rails show that western roads should shortly place some large orders. Money shows further improvement. The surplus reserves shown in Saturday's bank statement are substantially double the amount held at a corresponding time last year; call and time money are easier.

At the annual meeting of the American Railways Company in Camden, N. J., directors were re-elected. The annual report was approved.

Chicago City Railway earnings last month were 1.52 per cent more than for July, which were four and one-half per cent more than June. Monthly statements for last year were not published, but last month's increase over a year ago was 8.75 per cent. Total gross for May, June, July and August combined was $3,390,271.

The daily average traffic of the Metropolitan Elevated of Chicago this month is estimated at 163,000 passengers, or 18,783 more than a year ago, and a high record for any month. Some of the directors favor an increase in the dividend on the preferred early next year if travel continues good. It is also estimated that the year's earnings will equal the full five per cent on the preferred and about two per cent on the common. The preferred now gets three per cent.

DIVIDENDS.

Bangor Railway and Electric Company; regular quarterly one and one-half per cent, payable October 1 to holders of record September 15.

Bell Telephone Company, of Canada; regular quarterly dividend of two per cent, payable October 15 to stock of record September 24.

Butte Electric and Power Company; common dividend of one and three-quarters per cent, payable October 1; preferred dividend of one and one-quarter per cent, payable November 1.

Duluth Edison Company; quarterly one and one-half per cent on preferred, payable October 1 to holders of record September 21.

Electrical Securities Corporation; regular semiannual two and one-half per cent on preferred, payable November 1 to stock of record October 29. Regular quarterly two per cent on common, payable September 30 to stock of record September 30.

Manhattan Railway Company; guaranteed quarterly dividend of one and three-quarters per cent, payable October 1 to stock of record September 15.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES IN THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

NEW YORK.	Sept. 19.	Sept. 12.
Allis-Chalmers common	8	8
Allis-Chalmers preferred	29	30½
Amalgamated Copper	63	63¼
American Tel. & Cable	*80	*80
American Tel. & Tel.	124½	134½
Brooklyn Rapid Transit	75¼	73½
General Electric	142	140½
Interborough-Metropolitan common	21¼	17⅞
Interborough-Metropolitan preferred	55⅝	48¾
Kings County Electric	122	122
Mackay Companies (Postal Telegraph and Cables) common	88	89¼
Mackay Companies (Postal Telegraph and Cables) preferred	73⅝	73½
Manhattan Elevated	133¾	129
Metropolitan Street Railway	*18	*18
New York & New Jersey Telephone	103	103
U. S. Steel common	67¼	68⅛
U. S. Steel preferred	115½	116
Western Union	64½	62
Westinghouse common	59	58¼
Westinghouse preferred	*125	*125

*Last price quoted.

BOSTON.	Sept. 19.	Sept. 12.
American Tel. & Tel.	134½	134½
Edison Elec. Illuminating	256	256
General Electric	142	140½
Massachusetts Electric common	17	17⅛
Massachusetts Electric preferred	81	81
New England Telephone	130	130
Western Tel. & Tel. common	15	14½
Western Tel. & Tel. preferred	83	83

PHILADELPHIA.	Sept. 19.	Sept. 12.
American Railways	43¼	43
Electric Company of America	11½	11¾
Electric Storage Battery common	47	47⅛
Electric Storage Battery preferred	47	47¼
Philadelphia Electric	15¼	15
Philadelphia Rapid Transit	17¾	18¼
Philadelphia Traction	81¾	84
Union Traction	42⅞	43⅛

CHICAGO.	Sept. 19.	Sept. 12.
Chicago Railways, Series 1	60	70
Chicago Railways, Series 2	13⅜	16
Chicago Subway	4¼	4
Chicago Telephone	118	117
Commonwealth Edison	111½	110
Metropolitan Elevated common	18	19
Metropolitan Elevated preferred	61	60
National Carbon common	122	118
National Carbon preferred	119	118¼

PERSONAL MENTION.

J. A. MURRAY, for a number of years manager of the Baraboo Telephone Company, has purchased a third interest in the plant at Prairie du Chien, Wis., and will move to that city, taking control of the property on October 1.

THOMAS A. EDISON will exhibit the Edison poured-cement house for the first time at the cement show which is to be held at Madison Square Garden, New York, December 12-14. Mr. Edison has consented personally to install and supervise the exhibit.

WILLIAM G. McADOO is ill at St. Vincent's Hospital, New York City, where he is recovering from an operation for appendicitis. Mr. Mc Adoo's letter to the Public Service Commission embodying his company's proposal to build a subway from Broadway and Thirty-third Street through Broadway, University Place, Wooster, and Church Streets to the Hudson Terminal at Cortlandt Street, was dated September 12, only four days after he underwent the operation from which he is now recovering. The news that he was ill came out only after the Commission had made public his latest subway proposal.

FRANK C. MASON, former superintendent of Police Telegraph of Brooklyn, and a well known telegraph man, had as his guests recently at his farm at Washington Mills, near Utica, N. Y., a number of electrical gentlemen, some of whom were returning from the convention of Municipal Electricians at Rochester, N. Y. Mr. Mason welcomed his visitors at the Utica station with a new airship, bi-plane tpye, and took them to Glen Alex Farm in it, the team that hauled it making very good time. Among the visitors were W. L. Candee, George T. Manson, Frederick Pierce of New York, F. W. Sessions, and M. W. Van Auken, of Utica.

WALTER I. SWEET, of Port Richmond, N. Y., has been appointed assistant chief of the Division of Telephones and Telegraphs, to be in charge of the New York office. Mr. Sweet is forty-five years of age and has had extensive experience in telegraph, railroad and telephone service. In 1906 he was district manager of the Jersey City district of the New York and New Jersey Telephone Company and two years later, because of the merger of the functional and territorial organization with the New York Telephone Company, became local agent in charge of the commercial department of the Company. He was the senior officer of the Company in that district.

HUGH A. BROWN has been appointed manager of the Chicago office of the Garwood Electric Company with offices at 555 Old Colony Building. Mr. Brown has during the past eight years been actively engaged in the sale of electrical machinery in Chicago and Cincinnati. The appointment is considered a well-timed one for the Garwood Electric Company is now giving particular attention to special designs of direct-current motors and dynamos in addition to its complete line of standard "C & C" apparatus. Mr. Brown brings a technical training to this work, and the Company is anxious to take up special applications of motors and generators for any industrial purpose.

OBITUARY.

MICHAEL FRANCIS CUSHING, manager of the east division of the New York Telephone Company, comprising Suffolk and Nassau counties, and for thirty years with the Company, died September 12 at his home in Brooklyn after a week's illness. He was born in South Brooklyn, March 21, 1862.

NEW INCORPORATIONS.

ST. LOUIS, MO.—The Southern Electric Company has been incorporated with a capital of $6,000, by Wilfred Hearn, W. H. Close, and C. Schnyder. The firm will deal in electrical supplies of all kinds.

INDIANAPOLIS, IND.—The Hoyt Electric Company, capitalized for $50,000, has incorporated to manufacture and sell all kinds of electric devices and supplies. The directors are E. S. Vancamp, E. V. H. Shockney and E. T. Hoyt. S.

CHICAGO, ILL.—The Edison-Beach Car Company has been incorporated with a capital of $5,000 to manufacture electric batteries and appliances. The incorporators are William W. Wheatley, L. Wheatley and William S. Gore.

BEAUMONT, TEX.—The Neches Electric Company was recently incorporated and will do a general electrical contracting business. This company is a result of a consolidation of the Christopher Electric Company and the Neches Electric Company.

ALEXANDRIA, IND.—The Freeman Manufacturing Company has incorporated with a capital stock of $15,000. The company proposes to manufacture generators, heating and lighting apparatus and appliances. Albert S. Freeman, Virgil S. Day and V. H. Day are directors. S.

NEW YORK, N. Y.—The Straight Filament Lamp Company has been incorporated, with a capital of $300,000, to manufacture and deal in electric lamps, fitxures, etc., and to do electrical work of all kinds. The incorporators are: Fredk. W. Greenfield, Stuart L. Jaffray and William S. McCartney, all of New York City.

FOREIGN TRADE OPPORTUNITIES.

(From *Daily Consular and Trade Reports*, issued by the Bureau of Manufactures, Washington, D. C. In applying to the Bureau for addresses refer to file number.)

No. 5475. DREDGING.—A firm in the Netherlands writes the Bureau of Manufactures for the names of dredging contractors in the United States.

No. 5472. EXHIBITING AMERICAN GOODS IN BRAZIL.—An American consul in Brazil reports a firm in his district intends establishing a permanent exposition for the sale and exhibition of machinery and other industrial articles. The firm will accept goods on consignment, paying all the epenses connected with their entrance into the country and will also act as an agency for goods to be sold on commission. Catalogues, with prices and discounts, also allowances on goods sold on commission, are requested. Printed announcements accompanied the report and can be had at the Bureau of Manufactures. References are furnished.

No. 5534. WIRELESS TELEGRAPHY.—An American consular officer in a European country reports a second time that a local firm desires information and catalogues in order that it may bid upon the construction of stations 20 to 35 miles distance, complete with masts, for wireless telegraphy to be used in military operations. The government at present is much interested in this subject and is doing a great deal of experimenting, with a view to expending large sums of money in the near future. The report states this is a favorable opportunity for Americans interested in this line to introduce their goods. Further detailed information can be obtained by addressing the Bureau of Manufactures.

No. 5528. FLOUR-MILL MACHINERY.—An American consular officer in the Far East reports that a trading company in his district is acting as the agent for a newly formed flour-milling company which desires to obtain the entire equipment of the plant, including engine and boiler, from the United States. The company desires a mill that will turn out 2,500 sacks of 50 pounds each, daily. The purpose is to mill wheat of native production. As this is threshed on the ground by being trampled out under the hoofs of horses and oxen, the wheat is full of sand, small stones, etc., as well as containing many grains still covered by the husk and fragments of straw, and very thorough cleaning machinery will therefore be necessary.

PROPOSALS.

NAVY DEPARTMENT SUPPLIES.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will open bids on naval supplies on the dates given below. Bidders interested therein should make early application for copies of the schedule, giving the schedule numbers desired. Schedules can be obtained from the Navy Pay Office nearest each navy yard. Bids will be asked on the following supplies.

Date of Opening.	Article.	Quantity.	Delivery at navy yard.	Schedule No.
September 27—	Boxes, terminal	5	Annapolis, Md.	2892
	Buzzers	60	Annapolis, Md.	2892
	Cells, battery	26	Annapolis, Md.	2892
	Cable, double-braided	500 feet	Iona Island, N. Y.	2891
	Cable, lead-sheathed, etc.	33,100 feet	Annapolis, Md.	2892
	Lamps, mercury vapor	26	Brooklyn, N. Y.	2900
	Motors, direct current	4	Brooklyn, N. Y.	2901
	Telephones, w a l l mine	25	Annapolis, Md.	2892
October 4—	Appliances, wiring	Miscellaneous	Various	2890
	Bells and buzzers, w. t.	Miscellaneous	Various	2890
	Buttons, push	Miscellaneous	Various	2890
	Cells, dry	1,400	Various	2890
	Fittings, interior	Miscellaneous	Various	2890
	Fuses	Miscellaneous	Various	2890
	Generators, testing	30	Various	2890
	Gloves, etc.	Miscellaneous	Various	2890
	Hangers, insulators, etc.	3,700	Various	2890
	Heaters, electric	10	Brooklyn, N. Y.	2890
	Insulators, porcelain	3,000	Brooklyn, N. Y.	2890
	Irons, flat and soldering	Miscellaneous	Various	2890
	Keyboards, night signal	2	Puget Sd., Wash.	2890
	Lamps, arc, inclosed	10	Brooklyn, N. Y.	2890
	Lanterns, electric	Miscellaneous	Various	2890
	Portables, N. W. T.	375	Various	2890
	Sets, ventilating	10	Mare Island, Cal.	2890
	Sockets and rings for illuminating sets	12,000	Various	2890
	Sockets and receptacles	3,770	Various	2890
	Strips, searchlight	130 sets	Various	2890
	Switches, D. P., W. T.	300	Brooklyn, N. Y.	2890
	Tape, insulating, cotton	1,250 pounds	Various	
	Tape, insulating, rubber	180 pounds	Brooklyn, N. Y.	2890
October 11—	Fixtures, suspension	Miscellaneous	Puget Sd., Wash.	2902
	Supplies, electrical	Miscellaneous	Mare Island, Cal.	2902
	Wire, copper	8,500 feet	Mare Island, Cal.	2902
	Wire, copper	3,165 pounds	Mare Island, Cal.	2902

POST OFFICE, MACON, MO.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until October 10 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States post office at Macon, Mo., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Macon, Mo., or at the Supervising Architect's office.

POST OFFICE, TROY, ALA.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until October

24, for the construction, complete (including plumbing, gas piping, heating apparatus and electric conduits and wiring), of the United States post office at Troy, Ala., in accordance with drawings and specification, copies of which may be obtained from the custodian of site at Troy, Ala., or at the Supervising Architect's office.

POST OFFICE, TEMPLE, TEX.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until October 7 for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States post office at Temple, Tex., in accordance with the drawings and specification, copies of which may be obtained from the custodian of site at Temple, Tex., or at the Supervising Architect's office.

POST OFFICE, FAIRBURY, NEB.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until October 15 for the construction, complete (including plumbing, gas piping, heating apparatus, and electric conduits and wiring), of the United States post office at Fairbury, Neb., in accordance with the drawings and specifications, copies of which may be obtained from the custodian of site at Fairbury, Neb., or at the Supervising Architect's office.

POST OFFICE, CANANDAIGUA, N. Y.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until October 17 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States post office at Canandaigua, N. Y., in accordance with drawings and specifications, copies of which may be had at the office of the custodian of site, or at the office of the architects, Messrs. Allen and Collens, No. 6 Beacon Street, Boston, Mass.

INDUSTRIAL ITEMS.

THE CENTURY ELECTRIC COMPANY, St. Louis, Mo., recently increased its capital stock from $75,000 to $250,000.

KEUFFEL & ESSER COMPANY, Hoboken, N. J., has issued folders in which are described Paragon drawing instruments and Payzant (freehand) lettering pens.

THE JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J., recently distributed the September number of *Graphite*. A number of interesting items deal with the preservative value of graphite paint.

THE WAVERLEY COMPANY, Indianapolis, Ind., recently distributed two bulletins, one on the Waverley electric carriage and the other on Waverley commercial automobiles. Both bulletins are well illustrated and attractively prepared.

THE HURLEY MACHINE COMPANY, Chicago, Ill., illustrates by an amusing poster the part that the "Thor" electric washer has in securing new light and power business. This poster is the first of a series which will be mailed each month to every central station in the United States.

THE ACHESON GRAPHITE COMPANY, in order to give better service to its customers throughout the South, has opened a branch office at Atlanta, Ga. Much appreciation has been shown for the company's lubricants—Gredag, Oildag, Aquadag and pure powdered graphite—by the southern industries.

THE WESTERN REFLECTOR COMPANY, Chicago, Ill., has mailed catalogs in which are listed a variety of reflectors for use with electric, gas and oil lights. A number of styles in silver and opal glass, with double and single cones, are described and an illustration of each type is given. All of the leading styles are kept in stock for immediate shipment.

THE HART & HEGEMAN MANUFACTURING COMPANY, Hartford, Conn., recently distributed to the trade Catalog G and Price List No. 49. The former lists the company's H & H products and gives descriptions, illustrations and a number of diagrams showing how the switches may be wired. Prices for supplies listed in this catalog are given in Price List No. 49.

H. W. JOHNS-MANVILLE COMPANY includes in the September issue of *The J-M Packing Expert*, an account of an extremely long-lived Kearsage gasket. This gasket, which is on exhibition at the Cleveland branch office, has had eight years' continuous service and has been used ninety-six times. There are a number of other instances of long use of these gaskets given.

THE FOSTORIA INCANDESCENT LAMP COMPANY, Fostoria, O., has devoted a little booklet entitled "Lamps and the Man," to an explanation of the new ratings of lamps and to a resumé of the latest ideas on lamps and scientific illumination. The Mazda, tantalum and Gem lamps are mentioned and a number of valuable hints are given relative to the selection of a proper lamp for various uses. Copies of this boklet have been sent to practically every lamp consumer in the United States.

H. W. JOHNS-MANVILLE COMPANY, New York, N. Y., announces that branch offices have been opened at Atlanta, Ga., and Rochester, N. Y., for the convenience of its customers and to meet the growing business in these sections. The Atlanta office is located in the Empire Building in charge of W. W. Johns, who has been traveling in that territory for a number of years. The Rochester office is located at 725 Chamber of Commerce in charge of H. P. Domine, formerly with the Buffalo branch of the Company.

PETTINGELL-ANDREWS COMPANY, Boston, Mass., has published a handsome leather-bound catalog of its line of lighting fixtures. This company is well known as the pioneer among electrical jobbers in the fixture field and the excellence of its product is reflected in this catalog. The illustrations used give an adequate idea of the harmony of design and the practicability of the entire line. Original designs for these fixtures were made by Mr. Livor, manager of the company's fixture studios and credit for the engravings is due to Folsom & Sunergren. The catalog was printed by the Barta Press.

THE CONNECTICUT TELEPHONE AND ELECTRIC COMPANY, Meriden, Conn., announces that, for the best interests of all concerned, the sales arrangements existing between it and the Connecticut Shock Absorber Company will be discontinued October 1. On and after that date all inquiries should be addressed direct to the Connecticut Telephone and Electric Company, and the Connecticut Shock Absorber Company, at Meriden, Conn., unless such information refers to settlement of accounts for purchases made before October 1. In such cases inquiries should be addressed to the United Manufacturers, at New York, N. Y.

MATHIAS KLEIN & SONS, manufacturers of linemen's and electricians' tools, report that they are busy in both their old factory on Van Buren Street, and at the new factory on Clybourn Avenue. The Van Buren factory is now almost exclusively employed in the production of "Klein pliers" of various styles and sizes, side cutting, long nose, oblique cutting, flat nose, weaver nose, burner pliers and gas pliers, for which there is an ever-increasing demand. The Clybourn factory is employed in the production of the various items comprised in the general line of the firm's products. The firm advises that it will send its catalog to all responsible parties. Requests should be addressed to Station U-28, Chicago, Ill.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., recently mailed a number of bulletins dealing with electrical apparatus and installations. Bulletin No. 4749, besides being rather unique, will be of interest and will give much assistance to any one considering the purchase of switchboard panels. The panels illustrated in this bulletin are of the sectionalized type, and each section has a separate catalogue number. These panels are in three sections, and the pages of the bulletin are sectionalized so that the user may have before him a picture of the complete panel desired, together with a full description of the equipment. The electrical equipment of the Great Northern Railway is described in an attractive way in a bulletin entitled "Electrification of the Cascade Tunnel." The difficulties encountered before the electrification, and the manner in which they were overcome later, are told, and as these conditions are common to most of our trunk lines, the Great Northern electric system is of interest as an object lesson to show the ability of electric traction to increase the capacity of sections of railroads where, owing to certain physical conditions, operation with steam locomotive has reached its limit. Bulletin No. 4767 illustrates and describes motors designed particularly for use in steel mills. Among them are the 6,000-horsepower, 6,600-volt induction motors recently installed in the Gary plant of the Indiana Steel Company. The bulletin refers to both alternating and direct-current motors, and contains instructions as to the data which should be furnished when making inquiries in connection with the installation of motors for such purposes. Bulletin No. 4763, on the subject of isolated-plant-direct-current combination generator and feeder panels, supersedes previous bulletins on that subject.

DATES AHEAD.

American Mining Congress. Thirteenth annual session, Los Angeles, Cal., September 26 to October 1.

Kansas Gas, Water, Electric Light and Street Railway Association. Annual meeting, Kansas City, Kan., September 27 and 28.

Association of Railway Electrical Engineers. Annual convention, Chicago, Ill., September 27-30.

Vermont Electrical Association. Annual meeting, Brandon, Vt., September 28 and 29.

Denver Electric Show, Colorado Electric Club, Denver, Colo., October 8-15.

American Street and Interurban Railway Association. Annual convention, Atlantic City, N. J., October 10-14.

New York Electrical Show. Madison Square Garden, New York, October 10-20.

American Society of Municipal Improvements. Annual convention, Erie, Pa., October 11-14.

Western Association of Electrical Inspectors. Sixth annual meeting, Omaha, Neb., October 11, 12 and 13.

Railway Signal Association. Annual meeting, Richmond, Va., October 12-15.

American Electrochemical Society. Eighteenth general meeting, Chicago, Ill., October 13-15.

Order of the Rejuvenated Sons of Jove. Eighth annual meeting, Birmingham, Ala., October 13-15.

American Iron and Steel Institute. First meeting, New York City, October 14 and 15.

Illuminating Engineering Society. Annual convention, Baltimore, Md., October 24-25.

American Association of Electric Motor Manufacturers. Semi-annual meeting, Chicago, November 14-16.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) September 13, 1910.

969,773. PROCESS OF PRODUCING ALLOYS AND THE SEPARATION OF METALS. Percy Foote Cowing, New York, N. Y. Filed Nov. 11, 1909. The process of eliminating copper from alloys containing nickel and copper, consists in bringing the original alloy into solution electrolytically, substituting iron for copper in this solution, and electrolytically depositing nickel and iron from the solution thus obtained.

969,774. INTERCOMMUNICATING TELEPHONE SYSTEM. Hiram D. Currier, Chicago, Ill., assignor to Western Electric Company, Chicago, Ill. Filed Nov. 23, 1907. An intercommunicating telephone system having a trunk line leading to the system and multiplied with two or more stations thereof, comprises an induction coil and condenser individual to the trunk line and common to all stations, a telephone set at each of stations having the receiver and transmitter in series with each other, means for associating the telephone set with the local circuits of the intercommunicating system and with the trunk line, respectively, a normally closed shunt on the receiver, a retardation coil of low ohmic resistance and of high impedance value included in the shunt, and means for removing the shunt when the telephone receiver is associated with the trunk line.

969,787. PLUG-SWITCH. Henry E. Leppert, New Britain, Conn., assignor to The Hart Manufacturing Company, Hartford, Conn. Filed May 5, 1909. A spring contact having jaws extends in the direction of the axis of the plug; a support therefor is located in proximity to the mouth of the jaws; a carrier for the contact is interposed between the contact and the support, the carrier being connected to the support so as to be transversely movable.

969,788. FLUID-PRESSURE SYSTEM. Charles E. Lord, Norwood, Ohio, assignor to Allis-Chalmers Company. Filed Sept. 24, 1906. A fluid pressure system comprises a pump, an electric motor for driving the pump, a reservoir supplied by the pump, a switch controlling the motor circuit in response to variations in pressure of the fluid in the reservoir, and a slow-closing valve between the reservoir and the pump which is normally open to the source of fluid supply.

969,789. TELEPHONE-METER AND CIRCUIT CONNECTION THEREFOR. Ray H. Manson, Elyria, Ohio, assignor to The Dean Electric Company, Elyria, Ohio. Filed April 18, 1907. There are included: a time-registering mechanism, an electromagnet, an armature for the electromagnet, and devices carried by the armature for winding such mechanism and for releasing and stopping the same, such devices adapted to engage, wind and be disengaged from and also to release such mechanism as the armature is attracted and to stop such mechanism when the armature is released.

969,790. DYNAMO-ELECTRIC MACHINE. Emil Mattman, Norwood, Ohio, assignor to Allis-Chalmers Company and The Bullock Electric Manufacturing Company. Filed Aug. 1, 1907. A field yoke of magnetic material comprises a main portion and a nonintegral flange portion (attached thereto) provided with ventilating openings.

969,796. BRUSH FOR DYNAMO-ELECTRIC MACHINES. Edward T. Mug, Norwood, Ohio, assignor to The Bullock Electric Manufacturing Company. Filed Sept. 19, 1904. A flexible conductor for a carbon brush composed of a plurality of wires in a compact bundle, one end of the conductor being spread out through the body of the brush.

969,799. PRIVATE-BRANCH INTERCOMMUNICATING TELEPHONE SYSTEM. James L. McQuarrie, Oak Park, Ill., assignor to Western Electric Company, Chicago, Ill. Filed Nov. 23, 1907. A trunk line leads from a central office exchange to the intercommunicating system and is multiplied with two or more stations thereof, and a circuit closing device at the stations is associated with the trunk line and adapted to be substituted for the telephone set of the station for maintaining the circuit continuity of the trunk line.

969,805. OUTLET-BOX. Charles T. Pratt, Frankfort, N. Y., assignor to The Pratt Chuck Company, Frankfort, N. Y. Filed June 7, 1909. In an outlet-box, apertured for conduits, there is a plug for the aperture consisting of a disk having oppositely extending peripheral flanges which lie in a common plane and form a section of cone, one end of the section being wider and the other narrower than the aperture.

969,809. ALTERNATING-CURRENT MAGNET. Arthur Simon, Milwaukee, Wis., assignor to The Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Filed Oct. 8, 1906. There are means for producing fluxes of different phase and means for distributing the fluxes symmetrical to a common axis and in the same plane.

969,818. TELEPHONE-DROP. Alfred H. Weiss, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. Filed Nov. 25, 1907. A drop catch, pivoted to an armature has a flexible prong formed of a portion thereof engaging the armature and normally holding the armature in a position substantially at right angles to the catch but by its flexure permitting the armature to be moved substantially into the plane of the catch.

969,824. ELECTRIC SWITCH. Glenn S. Williamson, New York, N. Y. Filed March 10, 1910. A switch for a motor-driven hand-operated machine.

969,832. TELEPHONE APPARATUS. Garrison Babcock, Rochester, N. Y., assignor to Simplex Telephone Equipment Company, Rochester, N. Y. Filed July 11, 1907. A telephone receiver.

969,849. PORTABLE ELECTRIC HEATER. Frank L. Dyer, Montclair, N. J. Filed May 25, 1909. Includes a heater, a heating coil within the heater, a plug and connections between and joined to the same and the coil, and a chamber for inclosing the plug and connections when not in use integral with the heater.

969,856. INSULATED RAIL-JOINT. Lawrence Griffith, Yonkers, N. Y. Filed Sept. 2, 1908. An insulated fished joint.

969,859. TELEGRAPH-POLE AND THE LIKE. Broderick Haskell, Franklin, Pa. Filed May 22, 1909. A pole comprises a series of uprights U-shaped in cross section and having the open side inward (this side being entirely free of reinforcing or fastening means), and a series of transverse bands surrounding the outer U-shaped side of the uprights and securing the same in spaced apart relation, the uprights and bands being joined by molecular union of the connecting portions thereof.

969,862. TELEGRAPH-POLE AND THE LIKE. Broderick Haskell, Franklin, Pa. Filed Nov. 11, 1909. A pole comprises U-shaped uprights, transverse bands having pockets formed therein to receive the uprights, straps (secured to the bands adjacent the pockets) having centrally dished portions and filling blocks having wedge portions to co-act with the dished portions.

969,863. TELEGRAPH- POLE AND THE LIKE. Broderick Haskell, Franklin, Pa. Filed Nov. 11, 1909. A pole comprises uprights, transverse bands having pockets to receive the uprights, straps secured to the bands adjacent the pockets, plural filling members for each pocket, means to expand the filling members and means to react against the straps so as to exert clamping pressure throughout the area of contact.

969,866. MOTOR-STARTER. Clark T. Henderson, Pittsburg, Pa., assignor to The Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Filed Jan. 13, 1906. There are a plurality of electromagnetic windings arranged to be energized successively, a plurality of relay switches, one for each winding, adapted to arrest the successive operation of the windings, and a single device for actuating the relay switches.

969,876. SECONDARY BATTERY. Gustavus J. Johnson, Chicago, Ill. Filed March 28, 1910. A plate for supporting active material in contact with the conductor of the electrodes of an electric battery, has a surface permeable to the electrolyte and for the reception and retention of the active material. It has ribs on its opposite surface, and its edges are impervious to the electrolyte and electrically nonconducting.

969,892. COMMUTATOR BAR AND LEAD. Charles E Lord., Milwaukee, Wis., assignor to Allis-Chalmers Company. Filed Dec. 21, 1908. A commutator bar has grooves and an aperture communicating therewith, the grooves being on opposite sides of the bar.

969,894. METHOD OF AND MEANS FOR CONTROLLING REGENERATIVE ELECTRIC MOTORS. Robert Lundell, New York, N. Y. Filed Dec. 21, 1909. The method of operating a plurality of series motors arranged to drive a common load, consists in connecting the motors to the line with each motor field in series with its armature, impressing independent and practically constant voltages upon the several field circuits and regulating the field excitation by varying the ohmic resistances of the field circuits.

969,921. ELECTROLYTIC APPARATUS. William Thum, Hammond, Ind.. Filed Nov. 22, 1909. Includes a tank having an inclined floor, with an anode cell supported in the tank above the higher part of the floor and provided with a perforated bottom and side perforations, and anode and cathode terminals connected respectively with the anode material and a cathode at the bottom of the tank.

969,985. SIGNALING SYSTEM. Harry O. Rugh, Sandwich, Ill., assignor to Sandwich Electric Company, Sandwich, Ill. Filed June 26, 1908. A telephone system.

969,993. ELECTRIC IGNITING DEVICE FOR GAS-STOVES. Charles Stamm, Milwaukee, Wis., assignor of one-third to John Falbe, Milwaukee, Wis. Filed March 16, 1908. Renewed July 9, 1910. The act of turning on the gas operates a self-restoring trip device which produces momentary contact between a fixed electrode and a movable electrode.

969,994. TROLLEY-RETRIEVER. William Carleton Starkey, North East, Pa. Filed Nov. 23, 1908. There are devices on the spool for actuating a pawl, and for locking the retrieving disk with the spool.

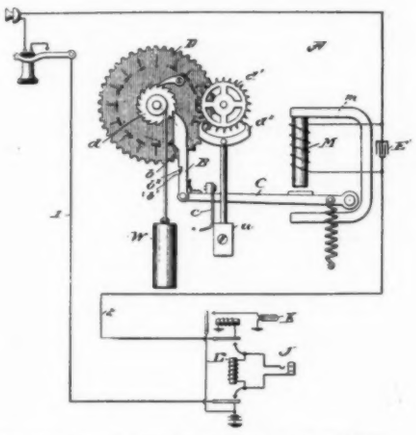
970,001. PROCESS OF ELECTRICAL SEPARATION. Henry Azor Wentworth, Lynn, Mass., assignor to Huff Electrostatic Separator Company, Boston, Mass. Filed Feb. 17, 1908. A process of separation of differentiated ingredients of comminuted solid material, consists in depositing the material upon a conductive surface under mechanical conditions favorable to gravitative movement of the material over the surface, agitating the material and simultaneously subejcting it to a motive component directionally divergent from the gravitative movement, at the same time directing an electric spray-discharge upon the material, thereby differentially modifying the responsiveness of ingredient particles to one of the motive components and subsequently separately collecting the separated ingredients.

970,089. BINDING-POST. Thomas E. Murray, New York, N. Y. Filed June 22, 1910. A binding post comprises a bifurcated shank, a sleeve thereon having a plurality of pairs of oppositely disposed recesses in its edge, each pair of recesses differing in size from the recesses of the other pairs, and the wire to be held being received in a pair of recesses of corresponding size and between the sleeve and the bottom of the shank, and means for holding the sleeve in adjusted position upon the wire.

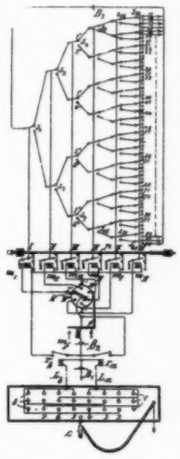
970,098. MACHINE FOR COVERING OR INSULATING WIRE WITH YARN OR ITS EQUIVALENT. Donald Noble, Bridgeport, Conn. Filed Aug. 5, 1909. Includes a tensioning device.

970,122. AUTOMATIC GAS CUT-OFF. Ludwig Schmidt and Herbert Schmidt, Kaiserswerth, near Dusseldorf, Germany. Filed Feb. 2, 1910. The device comprises a gas service pipe, a catalytic substance adapted to be subejcted to the action of gas escaping therefrom, means controlled by the catalytic substance for closing an electric circuit, and means actuated by the circuit for closing the gas service pipe.

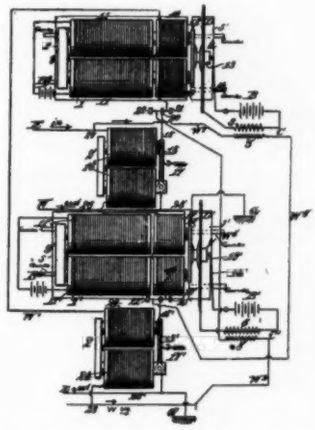
970,124. CIRCUIT-CLOSER FOR ALARMS. Frank A. Schultz, Wilkes-Barre, Pa., assignor of one-half to George Rollman, Wilkes-Barre, Pa. Filed Feb. 26, 1910. A circuit closer for fuse plug supported thereon, circuit terminals on the base and plug, relatively so disposed that circuit through the plug may be broken by reversing the plug end for end, a device for lifting the plug from the base, and means on the lifting device for reversing the plug.



969,789.—TELEPHONE METER AND CONNECTIONS.



970,367.—TRANSMITTER FOR TELESELECTORS.



970,288.—TELEPHONE REPEATER.

970,015. COVERING FOR MOUTHPIECES OF TELEPHONE-TRANSMITTERS. Annie K. Cann, Watkins, Colo. Filed Oct. 18, 1909. The covering consists essentially of a body portion folded upon itself, the upper extreme ends of the folds caused to adhere by gumming, to form a pocket for removable engagement with the transmitter, the opening in the outer fold being covered with a thin pliable fabric to cover the open end of the mouthpiece of the transmitter, the inner fold being provided with a slit (communicating with the lower part of the opening) adapted to fit over the mouthpiece of the transmitter, for the purpose of holding the cover in engagement with the mouthpiece.

970,066. TELEPHONE-TRANSMITTER. Oscar M. Leich and Niels Pedersen, Genoa, Ill., assignors to Cracraft-Leich Electric Co., Genoa, Ill. Filed June 19, 1908. A telephone transmitter comprises a suitable body, a diaphragm mounted therein, a bridge having apertures likewise mounted upon the body, for carrying the current-varying device, and leaf springs impinging against the diaphragm, having one extremity rigid with respect to the body, projecting through the apertures in the bridge and extending from the outer portion of the body toward the center of the transmitter, whereby a long spring action is obtained.

970,078. INSULATOR. John A. Meurling, Chicago, Ill. Filed March 19, 1910. There is a circumferential groove in the cylindrically shaped body piece, and sharp-cornered adjacent posts grip a wire by kinking it against a projection on the body.

970,087. BINDING DEVICE FOR CIRCUIT-CONDUCTORS. Thomas E. Murray, New York, N. Y. Filed March 10, 1910. The device comprises two plates having hook-shaped edges, seated one within the other, and having inwardly turned mutually overlapping flanges opposite to the hooks, and a clamping screw passing through both of the flanges to engage a conductor seated in the inner hook.

970,088. ELECTRIC CUT-OUT. Thomas E. Murray, New York, N. Y. Filed June 16, 1910. An electric cut-out comprises a base, a electric alarm circuits comprises standards mounted on a base, rods secured to the standards, a contact button secured to one of the standards and insulated therefrom, an open alarm circuit connected to the contact button and one of the rods aforesaid, magnet coils mounted on the other standard, an armature plate slidably mounted on the rods, and coil springs mounted on the rods and engaging the armature plate, the springs normally tending to actuate the armature plate into engagement with the contact button to close the alarm circuit.

970,169. ELECTRICAL PROTECTIVE APPARATUS. Jules A. Birsfield, Rochester, N. Y., assignor to Charles A. Brown and Lynn A. Williams, Chicago, Ill. Filed March 13, 1906. Renewed July 18, 1907. In combination with a line spring are an apparatus spring and a ground spring, the several springs being electrically insulated from one another, and a thermal device arranged to operate between the apparatus spring and the ground spring and normally in electrical connection with the apparatus spring and comprising a slender body portion and a supporting leg, the latter having electrical connection with the line spring and normally deflected from a given position to place it under lateral tension and adapted upon elongation of the body portion to regain its normal position and interrupt the apparatus circuit and close the ground circuit.

970,180. ELECTROMAGNETIC DEVICE. William S. Burnett, Milwaukee, Wis., assignor to Morse Code Signal Co., Milwaukee, Wis. Filed April 12, 1909. An electromagnetic coil is provided with a plurality of magnetizable core pieces magnetically separated from each other, and a plurality of devices are each separately controlled by one of the core pieces.

970,194. SLEEVE CABLE-TERMINAL. Robert S. Donaldson and Vincent E. Furnas, Louisville, Ky., assignors to Furnas, Brown & Plummer, Louisville, Ky. Filed Aug. 3, 1908. In a distributing terminal for telephone cables, the common lead sleeve is applied with wiped joints and provided with an integral receptacle, with fusible insulating compound in the receptacle, wires

extending from the cable within the sleeve. The sleeve is provided with orifices in its wall in the bottom of the receptacle for the exit of the wires from the cable. A cover is provided for the receptacle, with hollow screws secured in the cover, means provided on the screws to make connections, and the terminal wires from the cable are soldered in the upper end of the screws.

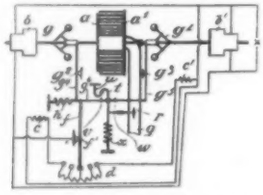
970,204. GAS-TURBINE. Erik August Forsberg and Birger Ljungström, Stockholm, Sweden. Filed April 13, 1907. A steam or gas turbine comprises two oppositely rotating vane systems and a direct-current electric generator connected to each system connected to the same circuit. Counteracting speed regulators are connected to the systems, the movement of the regulators changing at a variance of speed between the systems. A circuit regulator is operated by the speed regulators to regulate the exciting circuit to the field magnets of the generators in proportion to the different speeds of the systems.

970,211. TROLLEY-BASE. Charles E. Gierding, Newark, N. J., assignor to Sterling-Meaker Company, Newark, N. J. Filed June 7, 1909. A compound-spring base.

970,215. PREPARATION IMPERMEABLE FOR ROENTGEN RAYS. Oscar Gros, Leipzig, Germany. Filed June 29, 1910. The preparations consist of white bolus coated with bismuth oxides.

970,233. COMMUTATOR CONSTRUCTION. Fraser Jeffrey, Milwaukee, Wis., assignor to Allis-Chalmers Company. Filed Oct. 25, 1909. A commutator composed of segments has between its ends on the interior thereof an undercut slot, means for clamping the segments at their ends, and means for supporting and clamping the segments between their ends comprising a pair of clamping rings in the slot and wedges located between the rings and each engaging the adjacent faces thereof, the wedges serving when shifted outwardly to spread the rings so that the latter will tightly clamp the segments.

970,241. CLOCK-SYNCHRONIZING SYSTEM. Herman C. Korfhage, New Albany, Ind. Filed Nov. 22, 1906. The improvements described comprise a telephone exchange and a plurality of subscribers' circuits and instruments, normally adapted for



970,204.—GAS-TURBINE.

interconnection through the exchange, in combination with subscribers' electrically synchronizable clocks, connected with respective subscribers' circuits a normally quiet rotary generator for energizing the circuits to synchronize the subscribers' clocks and electromagnetic means for periodically disconnecting each subscribers' circuits from the exchange and master-clock mechanism for starting the generator and at a given instant energizing the electromagnetic means.

970,255. PULL-SOCKET FOR ELECTRIC INCANDESCENT LAMPS. John L. Moore, New York, N. Y. Filed Nov. 17, 1909. Includes an insulating block, a post secured to the block, a rotatable sleeve on the post and having teeth projecting therefrom, means for rotating the sleeve with a step-by-step movement, a sliding socket on the post and having notches adapted to be engaged by the teeth as the sleeve is rotated, whereby the socket is moved toward and away from the sleeve, and a switch operated by the movement of the socket.

970,264. DOOR-SWITCH. Johann G. Peterson, Hartford, Conn., assignor to The Arrow Electric Company, Hartford, Conn. Filed Nov. 3, 1909. A lever-actuated electric push-button switch.

970,288. TELEPHONE-REPEATER. Charles Adams-Randall, New York, N. Y. Filed April 15, 1905. A telephone repeating apparatus embodies two independent normally closed main-line circuits, each circuit being characterized by an electromagnetic line controlling device for rendering the circuits operative, one by the other, and an electric transmitter.

970,332. APPARATUS FOR USE IN EXERCISING, AND DEVELOPING AND APPLYING STATIC ELECTRICITY. Marcellus Munroe Hitt, Luray, Va., assignor to D. L. Kauffman, Luray, Va. Filed Dec. 21, 1909. Comprises a horizontal base and a vertical frame secured thereto, a supplemental brush-support consisting of a flat band arranged in contact with, and extending along, the upper portions of the frame, the edge of the band projecting beyond the frame.

970,367. TRANSMITTER FOR TELESELECTORS. Ernst Blos, Schöneberg, near Berlin, Germany. Filed Sept. 27, 1909. The transmitter comprises a divided local starting circuit for the controlling mechanism, a relay magnet in each branch thereof, a plurality of groups of fixed contacts in the starting circuit, the contacts of the several groups being connected with one or the other or both branches of the starting circuit to produce a different succession of impulses for each group of contacts, and a movable contact element connected in the circuit and arranged to successively engage the fixed contacts of any group upon manual operation thereof.

970,407. COOLING DEVICE FOR ELECTRICAL SLIDING CONTACTS. Boris von Ugrimoff, Moscow, Russia. Filed July 12, 1909. An electrical sliding contact comprises an inwardly-opening, revolving annular container, a revolving liquid conductor therein, a stationary conductor immersed in the liquid and a nozzle adapted to continuously spray a second liquid into the container and upon the liquid conductor.

970,410. CIRCUIT-SWITCH. Loyd Wilson, Detroit, Mich. Filed Feb. 3, 1910. In combination with a body block having a central longitudinal bore and radial cut-away portions reaching therefrom in a variety of directions, are circuit terminals located thereon adjacent to a plurality of diversely located points in the cut-away portion, and a removable key member provided with laterally projecting wing pieces complementarily located on the stem thereof with respect to the cut-away portions of the body block, adapted to pass therethrough and to register with those portions wherein the circuit terminals are located when the closure of the circuit is desired.

970,412. ELECTRIC MOTOR. Engelbert Arnold, Karlsruhe, Germany, and Jens Lassen la Cour, Vesteras, Sweden. Original application filed May 15, 1905. Divided and this application filed Oct. 5, 1908. An alternating-current motor.

970,420. STORAGE BATTERY. Rufus N. Chamberlain, Depew, N. Y., assignor to Gould Storage Battery Company, New York, N. Y. Filed Dec. 8, 1906. Includes a series of horizontal superposed trays.

970,449. TELEPHONE ATTACHMENT. Andrew C. Hewitt and William C. Thomas, Philadelphia, Pa., assignors of two-thirds to said Hewitt and one third to George W. Krout, Philadelphia, Pa. Filed April 14, 1910. A receiver holder.

PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States Patent Office) that expired September 19, 1910:

505,087. TELEPHONE. Joseph B. S. Booth and Ernest J. Falconner, Manchester, Eng.

505,097. ELECTRIC LIGHT FIXTURE. Benjamin F. Flint, Cincinnati, O.

505,098. REVOLVING ELECTRIC LIGHT. Benjamin F. Flint, Cincinnati, O.

505,123. INSULATOR PIN. James J. O'Neill, Boston, Mass.

505,170. TELEPHONE SWITCH. Thomas W. Ness, Montreal, Can.

505,183. ELECTRIC ARC LAMP. Arthur A. Atwater, Cleveland, O.

505,184. DYNAMO-ELECTRIC MACHINE. Arthur S. Atwater, Cleveland, O.

505,188. MULTIPLE SWITCHBOARD APPARATUS. John J. Carty, New York, N. Y.

505,204. CURRENT CONVEYOR FOR ELECTRIC RAILWAYS. William Lawrence, New York, N. Y.

505,207. AUTOMATIC REGULATOR FOR DYNAMO-ELECTRIC MACHINES. Orvis P. Philbrick, Somerville, Mass.

505,215. CLEAT FOR HOLDING A PLURALITY OF INSULATED ELECTRIC WIRES. Elisha W. Buffington, Fall River, Mass.

505,233. ELECTRIC ARC LAMP. Charles Schmid, Chicago, Ill.

505,241. ELECTRIC LIGHTING SYSTEM. Addison G. Waterhouse, Hartford, Conn.

505,247. ARMATURE FOR DYNAMO-ELECTRIC MACHINES OR MOTORS. Walter T. Kosinski, New York, N. Y.

505,263. ELECTRICAL METAL-WORKING. George D.Burton, Boston, and Edwin E. Angell, Somerville, Mass.

505,270. ELECTRIC DOOR-OPERATING APPARATUS. Oliver H. Hicks and Robertus F. Troy, Chicago, Ill.

505,271. ELECTRIC DOOR-OPERATING APPARATUS. Oliver H. Hicks and Robertus F. Troy, Chicago, Ill.

505,293. PRINTING TELEGRAPH FOR CASH RECORDING SYSTEMS. Henry K. Hess, Syracuse, N. Y.

505,346. ELECTRIC ILLUMINATED SIGN. Henry A. Bierley, Lexington, Ky.

505,351. ELECTRIC HEADLIGHT. Edgar A. Edwards, Cincinnati, O.

505,370. ELECTRIC-RAILWAY TROLLEY. Elbert R. Robinson, Nashville, Tenn.

505,383. ELECTRIC ARC LAMP. Sigmund Bergmann, New York, N. Y.

505,392. ELECTRIC PRIMARY BATTERY. Theophilus Coad, London, Eng.

505,393. ELECTRO-MEDICAL AIR INJECTOR. James Dawdy and Frank M. Cattern, Denver, Colo.

505,396. ELECTRIC MOTOR. Ernest R. Esmond, New York, N. Y.

505,419 and 505,420. BLOCK SIGNAL APPARATUS. Johann H. Frischen, Berlin, Germany.

505,422. ELECTRIC LAMP SOCKET. John M. Gardner, Jr., Pittsburg, Pa.